STEVENS RICE
UNIVERSITY MICROFILMS
313 N FIRST ST
ANN ARBOR MICH
A1J9

APPLIED HYDRAULICS

AUGUST 1956

THE MAGAZINE OF FLUID POWER
including Air Controls, Air Circuit Design and Electrical Controls...

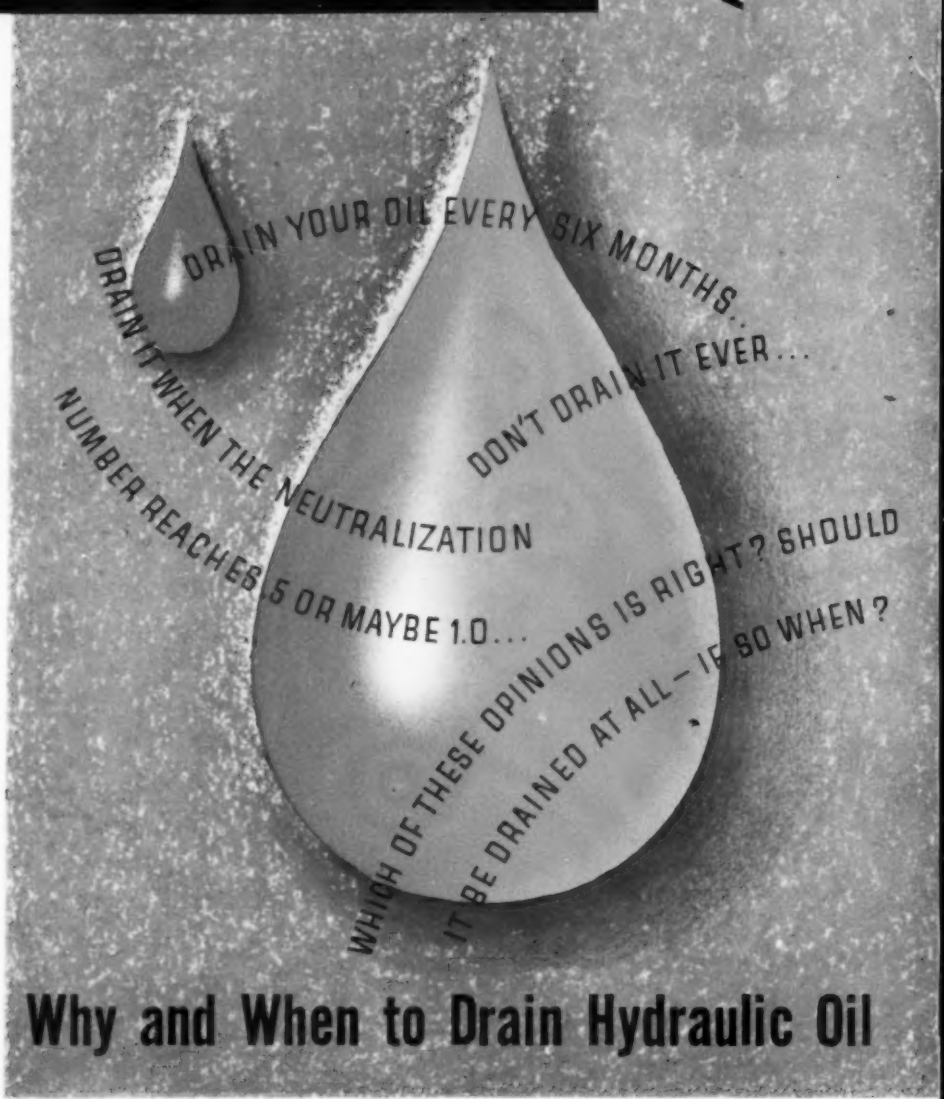
Pilot Check Times Accumulator Action . . . page 51

All Pneumatic Timing Circuits . . . page 54

Pressure Switches . . . page 56

Automobile Hydraulics . . . page 60

Aviation Section . . . page 80

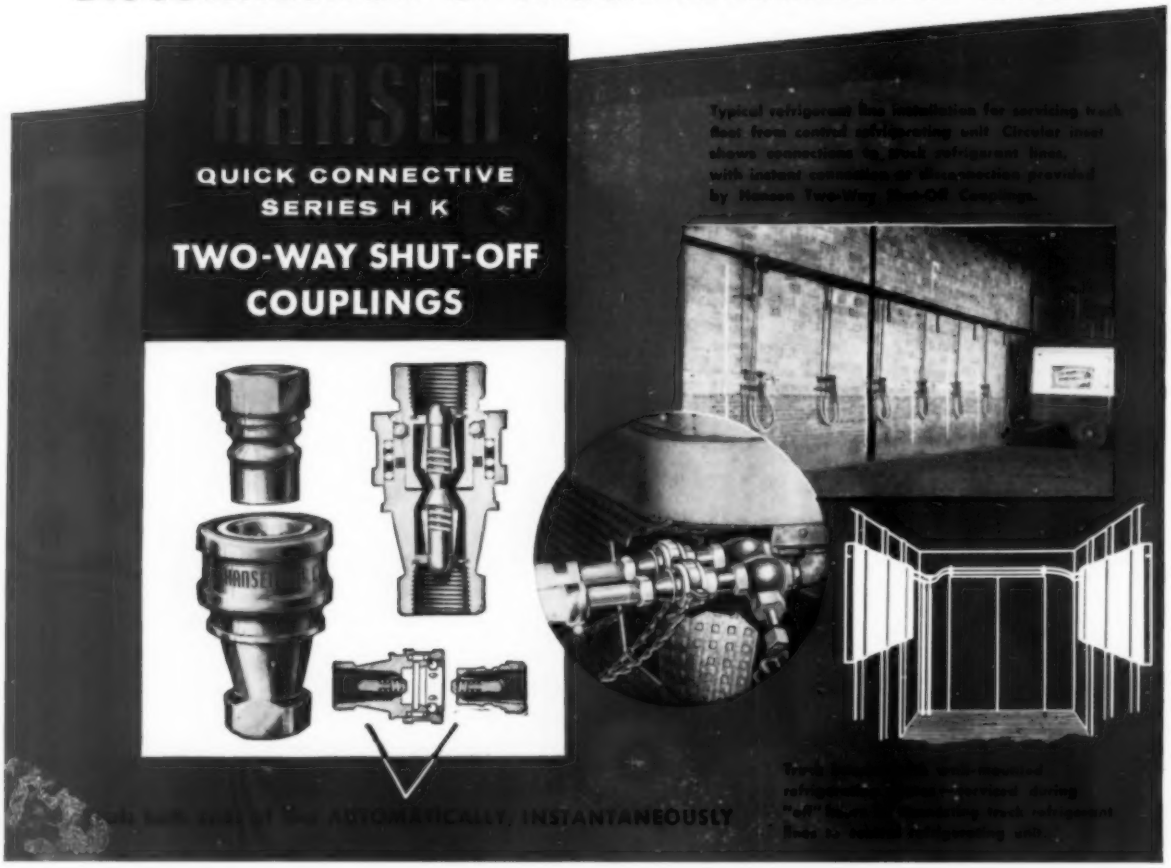

DRAIN YOUR OIL EVERY SIX MONTHS...
DRAIN IT WHEN THE NEUTRALIZATION NUMBER REACHES 2.5 OR MAYBE 1.0...
DON'T DRAIN IT EVER...
WHICH OF THESE OPINIONS IS RIGHT? SHOULD IT BE DRAINED AT ALL — IF SO WHEN?

page 47.... **Why and When to Drain Hydraulic Oil**

Plan Now to Attend the
NATIONAL CONFERENCE ON INDUSTRIAL HYDRAULICS
October 18-19 Chicago

In the Dairy Industry, too—

TO PROVIDE INSTANT CONNECTION AND DISCONNECTION OF TRUCK REFRIGERANT LINES



On almost a countless variety of applications, in many types of industry, Hansen Couplings provide instant connection and disconnection of fluid lines, eliminate costly delays—save time, effort and money.

To connect a Hansen Two-Way Shut-Off Coupling, you just pull back the sleeve and push the Plug into the Socket. To disconnect, merely pull back sleeve. No tools required.

Similar valves in Socket and Plug shut off both ends of line when Coupling is disconnected . . . practically eliminate spilling of liquid or escape of gas at instant of disconnection.

Hansen Series HK Two-Way Shut-Off Couplings are available with female pipe thread connections from ⅛" to 1" inclusive. Available in brass or steel.

Also Straight-Through and One-Way Shut-Off Couplings. Write for Catalog.

REPRESENTATIVES IN PRINCIPAL CITIES

SINCE 1915 ®

QUICK-CONNECTIVE FLUID LINE COUPLINGS

THE HANSEN MANUFACTURING COMPANY

4031 WEST 150th STREET • CLEVELAND 11, OHIO

Circle 47 on Reader Service Card

Here's GREATER POWER for you ...in a MORE COMPACT DESIGN

FEATURES YOU WILL LIKE:

- Greater power from a more compact design.
- Resistance to corrosion throughout.
- Positive sealing with minimum friction loss.
- Materials selected for strength, durability and long cylinder life.
- Interchangeable heads and mountings.
- Conformation to J.I.C. Standards.
- Automatic compensation for rod packing wear.
- Built-in piston rod scraper to prevent dirt and abrasives from scoring rod or damaging packings.
- Adjustable cushions of unique design.
- Wide choice of operating pressures; Air to 250 psi; hydraulic to 750 psi.

The New HANNA T 750 Series Fluid Power CYLINDERS

● You'll find some unique and very interesting operating features in these new Hanna **T750** Series Fluid Power Cylinders . . . features that will help you solve many of your cylinder application problems more easily and more simply. The new Hanna **T750** Series comes in a range of capacities, sizes and mounting styles—for air operation up to 250 psi and hydraulic operation up to 750 psi.

For details, ask your Hanna Representative (see your classified telephone directory), or write today for a copy of the new **T750** Fluid Power Cylinder Catalog. No obligation.

NEW CATALOG

Write for Catalog 750A—it gives complete details.

Hanna Engineering Works

1741 Elston Avenue, Chicago 22, Illinois

Circle 45 on Reader Service Card

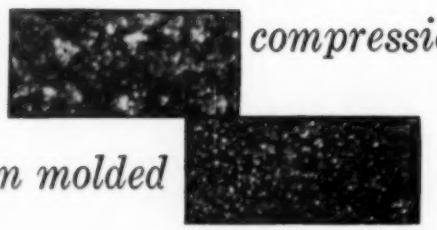
problem:

who makes longer-lasting rubber O-rings of ±.002" tolerance at low cost?

answer:

minnesota rubber and gasket company

evidence:



compression molded

injection molded

Minnesota Rubber O-rings are *injection molded* by the exclusive Minnesota Rubber process. Result is increased resistance to abrasions and chemical actions due to consistent, unequalled high density. Evidence of the greater density of injection molding is shown here in cross sections of Standard Buna N compound, .026"x.019", magnified 240 diameters by University of Minnesota.

In addition, Minnesota Rubber's O-rings have no flash. Tolerances can be kept within ±.002 inch. Cost? M.R. O-rings cost as little as ordinary O-rings! And M.R.'s 100% inspection and quality control saves you additional money in replacement costs, too.

free samples and data:

Free samples of Minnesota Rubber O-rings are available together with technical information and installation data.

minnesota rubber and gasket company

Originators of modern rubber injection molding
Dept. 104, 3630 Wooddale Ave., Minneapolis, Minn., Phone: WEst 9-6781

APPLIED HYDRAULICS

THE MAGAZINE OF FLUID POWER

AUGUST 1956

VOLUME 9 NUMBER 8

Bennett H. Horchler
General Manager

Paul L. Reed
Executive Editor

Paul Rolnick
Editor

A. W. Benkendorf
Associate Editor

Allan E. Morris
Associate Editor

John A. Lankester
European Editor

Alaric Mausser
Art Director

DEPARTMENTS

FLUID POWER LINES 6

LETTERS TO THE EDITOR 10

BRIEFS 18

FUTURE EVENTS 38

FLUID POWER PIONEERS 41

USEFUL LITERATURE 42

NEW PRODUCTS 44

IDEAS FROM A SALES ENGINEER 84

POST SCRIPTS OF INDUSTRY 112

MARKET PLACE 120

FEATURE ARTICLES

WHY AND WHEN TO DRAIN HYDRAULIC OIL 47
By R. Q. Sharpe

PILOT CHECK TIMES ACCUMULATOR ACTION ON SPIKE PULLING MACHINE 51

ALL PNEUMATIC TIMING CIRCUITS 54
By William J. O'Connell

PRESSURE SWITCHES FOR FLUID POWER CONTROL—PART 1 56
By Allan E. Morris

WHERE'S THE PLACE FOR FLUID POWER ON AN AUTOMOBILE? 60
By John A. Lankester

FOR A BETTER JOB USE AN AIR POWERED LEVER 66
By Daniel A. Keefe

PILOT OPERATED CIRCUIT STARTS GIANT 1500 HP MILL 70
By J. A. Krapf

OSCILLATING TORQUE MOTOR ELIMINATES COMPLICATED LINKAGES 74
By B. A. Pearson

AVIATION SECTION

SELF-DISPLACING ACCUMULATOR SHORTENS LINES AND MINIMIZES PRESSURE LOSSES.. 80
By Scott Hawkins and E. R. Cooper

BPA

THE INDUSTRIAL PUBLISHING GROUP
(Division of Telenews Productions, Inc.)

Copyright 1956

now . . . AIR VALVES

WITH EXTREMELY FAST RESPONSE

. . . Almost TWICE As Fast As Ordinary Valves!

The new SA Series single solenoid actuated valves are available in both single and dual pressure models with extremely fast response time. You get total response in 12 *milliseconds*—from energizing to wide open on 60 cycle current. That's almost *twice as fast* as any pilot operated solenoid control valve available today!

All SA Series valves are high performance, full pipe area valves . . . furnished for service on vacuum and air at pressures from atmospheric to 250 psi . . . and at speeds from the most intermittent job in your plant to welding guns. Optional metering valves give simple, sensitive control of piston speed by metering the exhaust air. Exhaust noise is muffled.

The design simplicity of the SA Series valves provides extremely long life and requires a real minimum of maintenance. Only one moving part provides the valving action . . . a corrosion-resistant steel spool and sleeve.

Complete information on the SA Series valves . . . the greatest advance in air controls . . . can be obtained by writing today for your copy of Catalog 8000.

NUMATICS, Inc.

MILFORD, MICHIGAN • DEPT. AH

APPLIED

HYDRAULICS

Published monthly by
INDUSTRIAL PUBLISHING GROUP
(A Division of Telenews Productions, Inc.)
812 Huron Road Cleveland 15, Ohio

IRVING B. HEXTER ..... President
LESTER P. AURBACH
..... Executive Vice-President
EDWIN M. JOSEPH ..... Vice-President

BUSINESS STAFF

BENNETT H. HORCHLER General Manager
WILLIAM L. JERSE ..... Production Manager
N. G. KISER ..... Circulation Director
HAROLD BEHM ..... Franchise Manager

SALES OFFICES

CLEVELAND 15 ..... SUperior 1-9622
R. D. SHATTUCK

NEW YORK 17 ..... MUrray Hill 7-3420
LEE HAAS, Eastern District Manager
V. R. STEIN, Administrative Assistant
RONALD ROSE
60 E. 42nd St.—Room 803

CHICAGO 11 ..... WHitehall 3-1655-56-57
CHARLES F. GEYER, Manager
S. R. TRACY
520 N. Michigan Ave.—Room 1613

LOS ANGELES 5 ..... DUnkirk 9-9364
ALAN T. CAZIER, Manager
3460 Wilshire Blvd.—Room 1003

LONDON S.W.1 ..... Victoria 2608
JOHN A. LANKESTER, Manager
31 Palace St., Westminster.

EUROPEAN REPRESENTATIVE .....
ERICH BOPP
22b Ingelheim (Rhein)
Western Germany

JAPAN .....
F. C. TAYLOR
American Trading Co. (Japan) Ltd.
No. 1 Shiba Park 7-Gochi
Minato-Ku, Tokyo

●

Also publishers of COMMERCIAL REFRIGERATION & AIR CONDITIONING, PRECISION METAL MOLDING, FLOW, INDUSTRY & WELDING, OCCUPATIONAL HAZARDS, MODERN OFFICE PROCEDURES, MATERIAL HANDLING ILLUSTRATED, and WELDING ILLUSTRATED. Member, Business Publications Audit of Circulation, Inc.

Subscription in United States and possessions—$5.00 per year; Canada—$6.00 per year; Foreign—$7.00 per year, except United Kingdom. United Kingdom subscription £ 2.5.0 per year, payable in Sterling to our London Office. Single copy price, 50 cents. All subscriptions subject to individual acceptance by the publisher.

Accepted as controlled circulation publication at Pontiac, Illinois. Please return 3579 forms to 812 Huron Road, Cleveland 15, Ohio.

Know

that you have the Right Hose Assembly always—

Specify

ANCHOR!

Whether it is for high, medium or low pressure, there's an Anchor Hose Assembly that's been designed for the particular type of job you have in mind! Anchor Couplings are engineered for long, dependable service without danger of leaks or blow-offs and with a substantial margin of safety over specified operating pressure ranges.

Andy Anchor **says:**

The catalogs listed below offer you a wealth of engineering data and the complete construction details of Anchor Hose Assemblies, Couplings and Fittings. Send for them!

Catalog No 100 — Anchor Pressed-On Hose Assemblies

Catalog No. 201 — Anchor Adapter Unions, Pipe Fittings and the new SAE Boss Type Fittings — see SAE standards, Page 825, 1956 SAE Handbook.

Catalog No. 301 — Anchor Clamp Type and Reusable Hose Couplings

Catalog No. 400 — Anchor Flanco 4 Bolt-Split-Flange Couplings — conforming to SAE standards, Page 823, 1956 SAE Handbook.

ANCHOR COUPLING CO. INC.

369 North Fourth Street • Libertyville, Illinois

Branch Offices: Dallas, Tex.; Plymouth, Mich.

Remember also ...."ANCHOR" for specials

ANCHOR HOSE AND TUBE COMBINATION ASSEMBLIES OFFER IMPORTANT ADVANTAGES

Representative of many special types of assemblies being developed and manufactured by Anchor, are the two illustrated below. They combine hose and tube in any proportion of length, in any shape and with any choice of coupling style such as: the Anchor exclusive SAE Standard Split-Flange Couplings, the Clamp Types, or Pressed-On Couplings, to satisfy specific requirements.

Among the many advantages of this type of assembly are:

1. Saving of space
2. One less joint
3. Shorter bends made possible
4. Neater and easier installations
5. Lower initial cost of assembly

We invite you to send us a description of all of your hose assembly problems for recommendations. Anchor Coupling Co. Inc., 369 North Fourth Street, Libertyville, Illinois. Branch Offices: Dallas, Tex.; Plymouth, Mich.

Fluid Power Lines

about Applied Hydraulics

OIL POWER WITHOUT OIL . . . just wouldn't make sense at all would it? But how about oil power with poor oil? Doesn't make sense either. But the problem is now somewhat different. While no one with all his buttons would try operating a hydraulic system with a tank full of air, many machines are "operated" with a tank full of oil that should have been discarded.

For the user who is not sure about what he should do to hydraulic oil once its in the system, Bob Sharpe's article in this issue will serve as an excellent guide.

In his job as Senior Engineering Representative for Socony Mobil, Bob travels a great deal. Chances are good that you've met him or heard him speak at one of the many meetings he attends each year. He's been very active in the National Conference on Industrial Hydraulics. At this year's Conference he will be chairman of the session on hydraulic fluids.

SEQUEL IN DESIGN . . . Exactly four years ago we wrote an article describing the hydraulic circuit used on a portable puller for railroad tie spikes. In this issue on page 51 is a sequel to the design. Speed of operation has been increased by better utilization of power from an accumulator and by designing a two stage cylinder which does the job with less oil. Drawings in the article detail the cylinder design and the accumulator control valve.

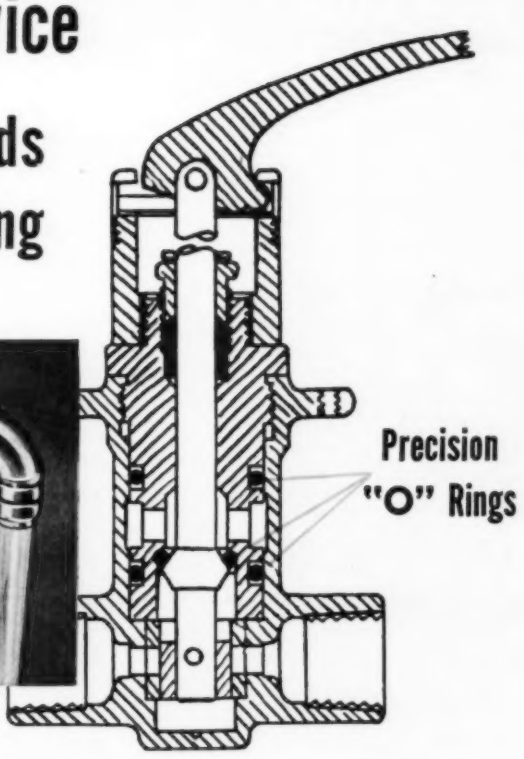
"PUT THE WINDOW HANDLES BACK ON . . . Hydraulics may be wonderful for the brakes and the transmission but those window lifts are a nightmare." This statement is a well ventilated version of what the service manager at our auto dealer gets from customers who were brave enough to buy a model with hydraulic window lifts. This is an application which didn't make any friends for good old fluid power. But maybe the French automobile designers are going to give a helping hand in the proper application of oil power on passenger cars. European editor, John Lankester, details the design of the hydraulic system on the Citreon DS19 in an article starting on page 60. We are intrigued by this design which is aimed at reducing operator fatigue without sacrificing much engine efficiency.

DO THE WHOLE JOB WITH AIR . . . Bill O'Connell's article starting on page 54 shows four ways to time air cylinders without using electrical controls. He's used these circuits on equipment at Moraine Products Div., General Motors Corp., Dayton. Control is with a time delay pilot valve and a cut-out valve which passes a preset amount of air and then closes. If the accuracy of timing given by these circuits is suitable for your work, these all-pneumatic circuits will save you money.

THE FIFTH ARTICLE . . . in AH's series on electrical components starting on page 56 discusses pressure switches. These are often used on fluid power equipment, because they present the best method for sequencing the machine cycle, especially when piping must be held to a minimum for a compact design.

New Faucet with Precision "O" Rings gives longer service

...ends dripping

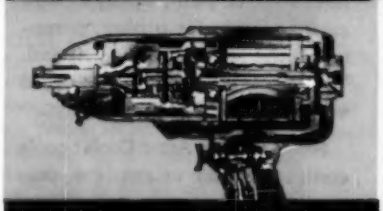


The Gyro Brass Manufacturing Corporation water faucet has no washers, spindles or seats to replace or renew. With the aid of Precision "O" Rings, a single motion controls both water volume and temperature. Dripping is eliminated. Endurance tests indicate ring life of over 15 years of normal service.

For Gyro Brass Manufacturing Corporation, and for hundreds of other manufacturers, the use of Precision "O" Rings means dependable long life service. They are compression molded—rigidly inspected—meet all military and commercial specifications—the finest made! At Precision, you'll find "O" rings in sizes and compounds to meet your requirements.

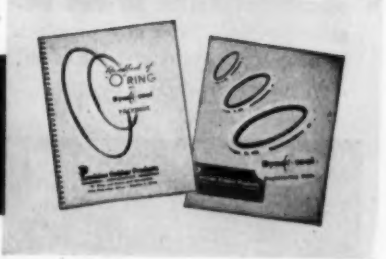
What is your sealing problem? There is an expert—the Precision engineer—ready to help you in product design and "O" ring specifications. You can rely on him—and on Precision, the world's largest exclusive producer of "O" Rings.

Job fitted Precision "O" Rings have solved hundreds of industrial, aircraft and automotive sealing problems.



In air-powered impact wrench, 14 floating "O" rings help achieve compactness, result in reduced break-out friction and lower running friction.

Write for your free copies of Precision catalogs on "O" Rings and Dyna-seals



Precision Rubber Products Corporation • "O" Ring and Dyna-seal Specialists

Dept. 1, Oakridge Drive, Dayton 7, Ohio

Canadian Plant at: Ste. Thérèse de Blainville, Québec

HOW YOU SAVE...

...getting drier Compressed Air

● Save the cost of cooling water and you save the price of the Niagara Aero After Cooler (for compressed air or gas) in less than two years.

Extra, for no cost, you get drier compressed gas or air for your process. You get better operation and lower costs in the use of all air-operated instruments, machines, or paint sprays. You save expense for piping, pumping, water treatment and disposal. You get the use of badly needed water elsewhere in your plant.

Niagara Aero After Cooler cools compressed air or gas (evaporatively) below the temperature of surrounding atmosphere, with no further condensation in your air lines.

Write for complete information; ask for Bulletin No. 98, or contact nearest Niagara Engineer if you have any problem involving the industrial use of air. Address Dept. AH.

NIAGARA BLOWER COMPANY
405 Lexington Ave., New York 17, N.Y.
District Engineers
in Principal Cities of U. S. and Canada

Fluid Power Lines

continued

HYDRAULICS AND THE FERRIS WHEEL . . . Ever consider the design of the roller coaster, the "bug" or any of the large variety of amusement park rides? We're impressed by the age, safety, reliability and low maintenance of most of these rides. And the ingenuity and novelty of some of them competes with the best designs for production. All this brings us to the hog fuel rake article, page 74. It's a hard working, oil powered machine, which we think an amusement park owner would do well to consider, as the newest, most thrilling, most collossal ride of the year.

GROWTH INDUSTRY . . . During the past 18 months four AH editors have discovered a "for real sure" growth industry. They have all invested heavily and will continue to do so for a number of years. These fathers are ready to display photos on a moment's notice. So meet John Lankester's Christine, and Bert Benkendorf's Judy. And to even up the sides are Gerald Morris and Stevie Rolnick. With all our combined experience, time seems to be the only solution to the hydraulic problems presented by these wonderful kids.

Steven

Judith

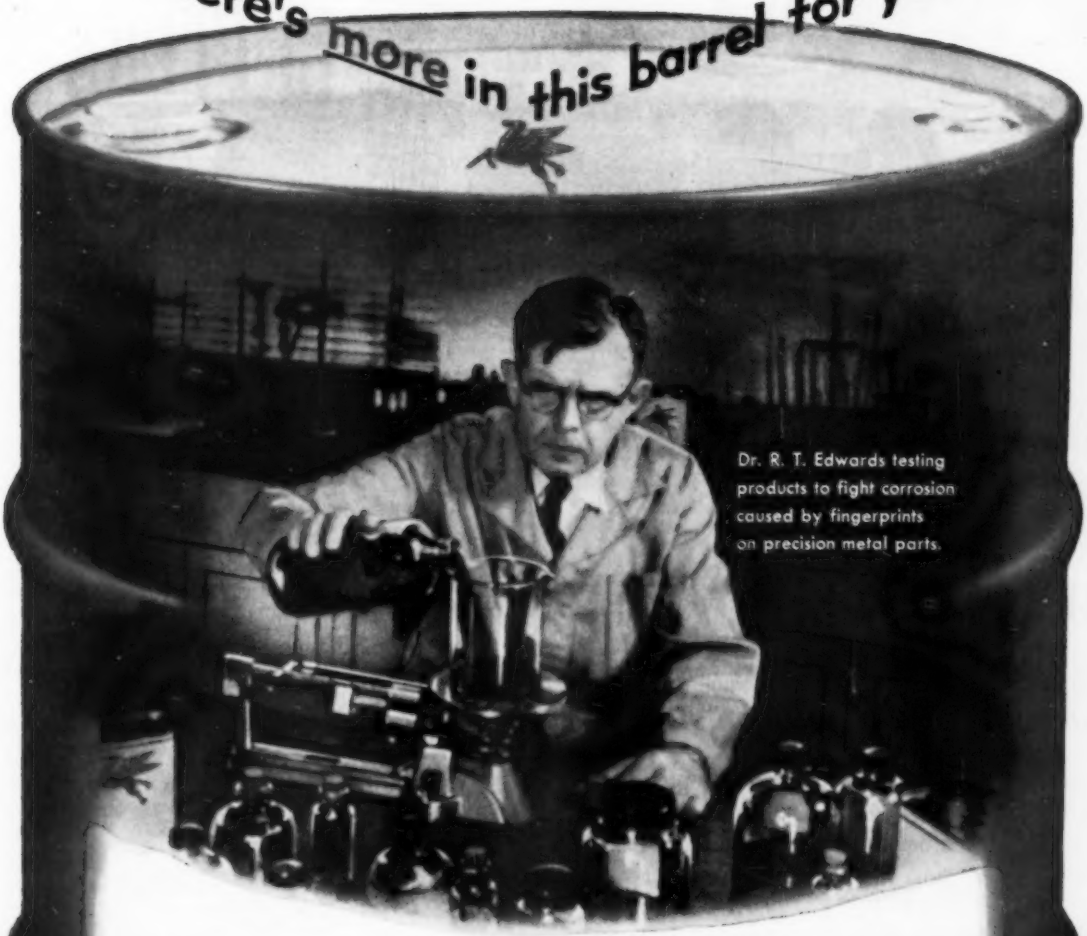
Christine

Gerald

All this activity has Paul Reed planning for a grandchild.

HYDRAULIC SPECIALIST . . . As most of our readers know, whenever an AH editor meets someone who designs and uses hydraulic equipment, bells start ringing, eyes light up and a pencil goes into action. Last winter, when we met Al Krapf, who wrote the article starting on page 70, our, pencil couldn't keep pace with the ideas he threw at us. Al's experience with hydraulics has been in a steel mill where operating conditions are rugged to say the least. Steel mill applications led him into the design of valves, fittings and accumulators. He also has a large number of unusual circuit designs—one of these designs he describes in his article.

There's more in this barrel for you...



Dr. R. T. Edwards testing products to fight corrosion caused by fingerprints on precision metal parts.

MORE CONTINUOUS RESEARCH

to help you improve production and cut costs!

When you specify "Socony Mobil," you get petroleum products backed by *more continuous research* than those of any other oil company! This means products which are *continually improved* in quality and performance—*new* products when needed. Equally important . . . these complete research facilities are available to *you*—to help improve your production and lower your unit costs.

Socony Mobil products are also backed by *more* field engineers serving industry . . . *more* services for analyzing petroleum products in use . . . *more* on-the-job training of your personnel in correct product application . . . *more* approvals from machine builders . . . *more* practical experience—90 years!

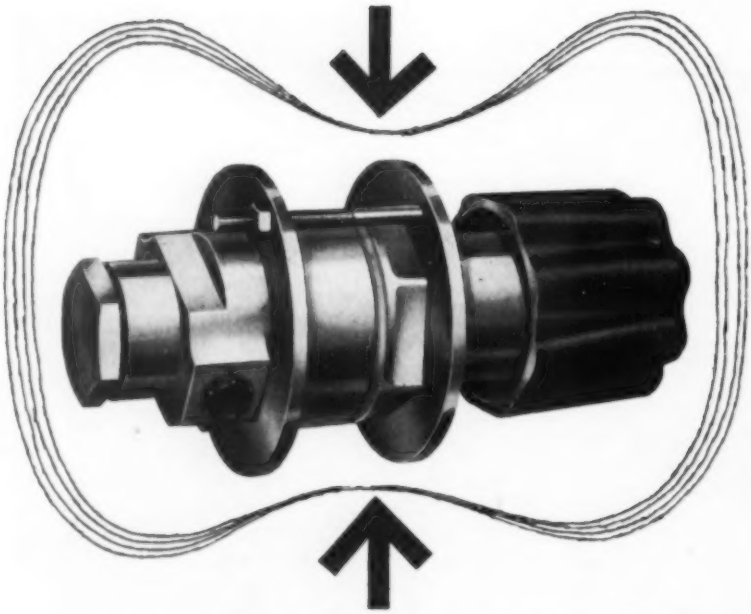
Always specify Socony Mobil. There's *more* in every barrel for you!

SPECIFY **SOCONY MOBIL**

FIRST STEP IN CUTTING COSTS

SOCONY MOBIL OIL CO., INC., and Affiliates: MAGNOLIA PETROLEUM COMPANY
GENERAL PETROLEUM CORPORATION

LUBRICANTS · FUELS · CUTTING FLUIDS · WAXES · SOLVENTS · PLASTICIZERS · PETROCHEMICALS



REVOLUTIONARY, NEW HIGH PRESSURE REGULATOR

Look at these outstanding new developments:

- Widest adjustment range available for manual regulation due to greater sensitivity created by a new engineering innovation!
- ¼" tube straight thread gasket seal bosses per AND10050!
- Maximum inlet pressure of 4500 psi!
- Internal relief valve and filter!
- Internal valve and filter are removable without disturbing spring, diaphragm structure!

Catalog Number	Adjustable Range Outlet Pressure PSI
110100-2	5/150
110100-4	15/300
110100-6	30/750
110100-8	150/1500
110100-10	400/3000

Write today for new engineering data sheet and catalog covering our complete range of regulators.

APCO **ACCESSORY PRODUCTS CORP.**
Dept. A8, 616 W. Whittier Blvd.
Whittier, Calif. Phone: OXford 3-3747

LETTERS to the editor

Wants a Source of Supply

We manufacture low bed trailers. For our tilting platform trailers we require buffers consisting of a double acting ram with a reservoir constructed around the ram cylinder and two flow valves, restrictive in one direction, incorporated inside the reservoir.

For our tagalong trailers we require a parking and lifting leg, consisting of a single acting, telescoping ram, not over 10 inches long, when collapsed, and capable of lifting a 12 ton load. Also an inexpensive 4-way valve to be used with another type of double acting parking leg is needed.

Who manufactures this type of equipment?

R. C. SMITH
Trailer Division
L. B. Smith Inc.
Camp Hill, Pa.

There are a number of manufacturers specializing in hydraulic components for mobile equipment who could be contacted. Some of your requirements may not be standard components. We've sent a list of companies to you.

Glycerine Sequel

In May, John Craig asked in these columns for information about the use of glycerine in hydraulic systems. I have acquired considerable experience on this subject as Flight Deck Engineer Officer on the only Royal Netherlands Navy aircraft carrier, *HNMS Karel Doorman.*

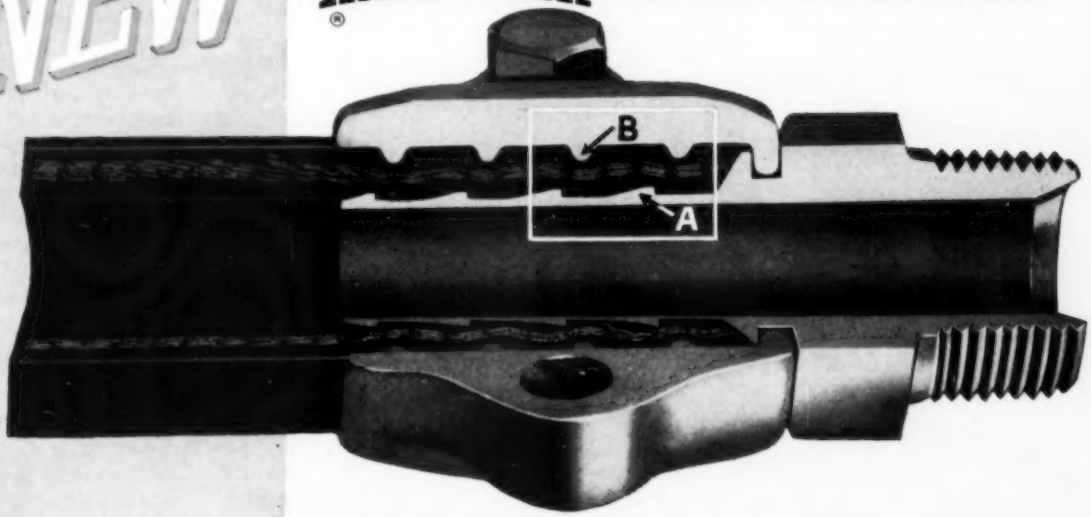
When the ship sails under arctic conditions, a mixture of 49% water, 49% glycerine and 2% soluble oil is used. Glycerine is added to prevent freezing of the fluid and the soluble oil is added to maintain a stable mixture and provide lubricity.

The most important disadvantages to this mixture are: **1. Physical instability.** Because it's impossible to get a thorough emul-

Continued on page 12

NEW Eastman

INTER-LOCK® CLAMP COUPLING



EASTMAN MFG. CO. announces its New **Inter-Lock** Clamp Coupling—offering *exclusive grip advantages* available in no other coupling of its type.

EXCLUSIVE EASTMAN INTER-LOCK FEATURES

Eastman's New **Inter-Lock** Clamp Coupling provides positive positioning through accurate machining of clamp and insert—as the outside rib of the clamp is locked between the collar and hex of the insert, before tightening.

The accurate location of the clamp over the insert assures alternate mating of the barbs of the insert (A) with the circular ribs of the clamp (B).

Hose is uniformly compressed into each alternating recess—increasing the holding power of the Clamp Coupling—thereby creating **Eastman's Exclusive Inter-Lock Grip.**

Longer service is assured because hose construction is not weakened by pinching, as it may be if ribs and barbs were permitted to fall directly opposite each other.

EASTMAN'S Exclusive **Inter-Lock** feature is another example of advanced design and engineering which gives you greater value, plus the *all-important competitive advantage* of superior product performance and customer satisfaction in the field.

Look to EASTMAN . . . *first in the field* of Hydraulic Hose Assemblies . . . for continued leadership in design and engineering—plus the highest quality material and workmanship.

STANDARD INSERTS FOR EASTMAN INTER-LOCK CLAMP COUPLING

For low, medium and high pressure hose up to 5000 psi. working pressure. Available for hose sizes ranging from ¼" to 2" I.D.—according to pressure requirements. Also available for angle and straight tube applications.

SWIVEL FEMALE

MALE PIPE

MALE FLARE

INSERT FEATURE
Beveled shoulders of barbs permit easy insertion into hose.

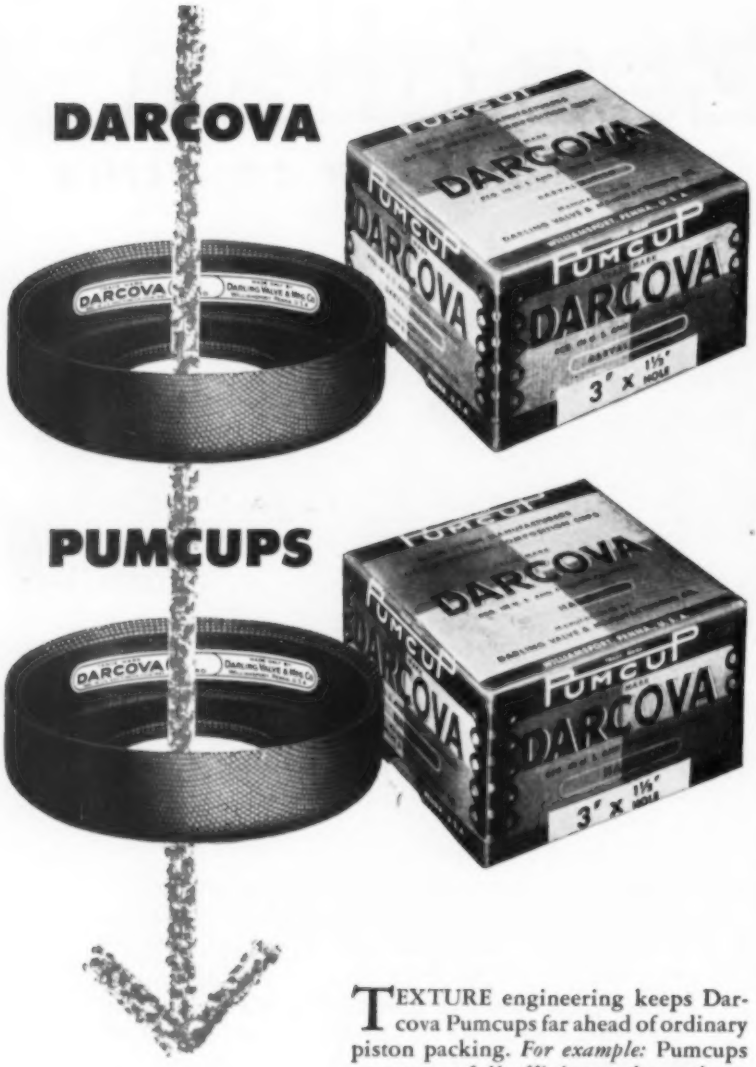
WRITE for Standard Sizes or send your blueprints and specifications.

SAFEGUARDING INDUSTRY'S Lifelines of Mobile Power

Eastman *first in the field*

MANUFACTURING COMPANY
Dept. AH-8, Manitowoc, Wis.

Circle 34 on Reader Service Card



...famous for

- PUMPING EFFICIENCY
- LOWER COST
- LONGER SERVICE

TEXTURE engineering keeps Darcova Pumcups far ahead of ordinary piston packing. *For example:* Pumcups operate at full efficiency throughout their entire life. Fluid slippage is virtually eliminated.

Moreover, you can count on much longer service . . . users report Darcova Pumcups outlast other packing at least 3 to 1!

Write for all the facts on Darcova efficiency: Bulletin No. 4502 on Pumcups for air and hydraulic mechanisms; No. 4401 on Pumcups for reciprocating pumps.

DARLING VALVE & MANUFACTURING CO.
Williamsport 15, Pa.

DARCOVA
THE ORIGINAL COMPOSITION CUP
PUMCUPS

LETTERS to the editor

sion of the glycerine and water, the water sinks out if the system is not used frequently. Addition of more soluble oil to improve stability results in attack on yellow metals and some kinds of packing materials. **2. Chemical instability.** The mixture has a strong tendency to turn acid. The higher the working temperatures and pressures the faster this reaction. Samples have to be drawn frequently to check alkalinity, salinity and percentage of glycerine and soluble oil. A slight grade of alkalinity has to be kept up with additives such as caustic potash. Salinity has to be kept down as low as possible by using distilled water. Both an alkalinic or an acid mixture or even a fluid with high salinity will attack leather or synthetic packings.

Since I'm not exactly raving about glycerine and water, may I give some advise from the Old World to my colleagues in the New World:

Stick to your own new wonderful hydraulic fluids and even when you have to build a hydraulic system on the North Pole try to find fluids that are non-freezing, chemically and physically stable and that don't need so much care.

And when you have found such a fluid please let us know.

W. A. VAN LEEUWEN
Lieut./Eng'r/R. Neth. Navy

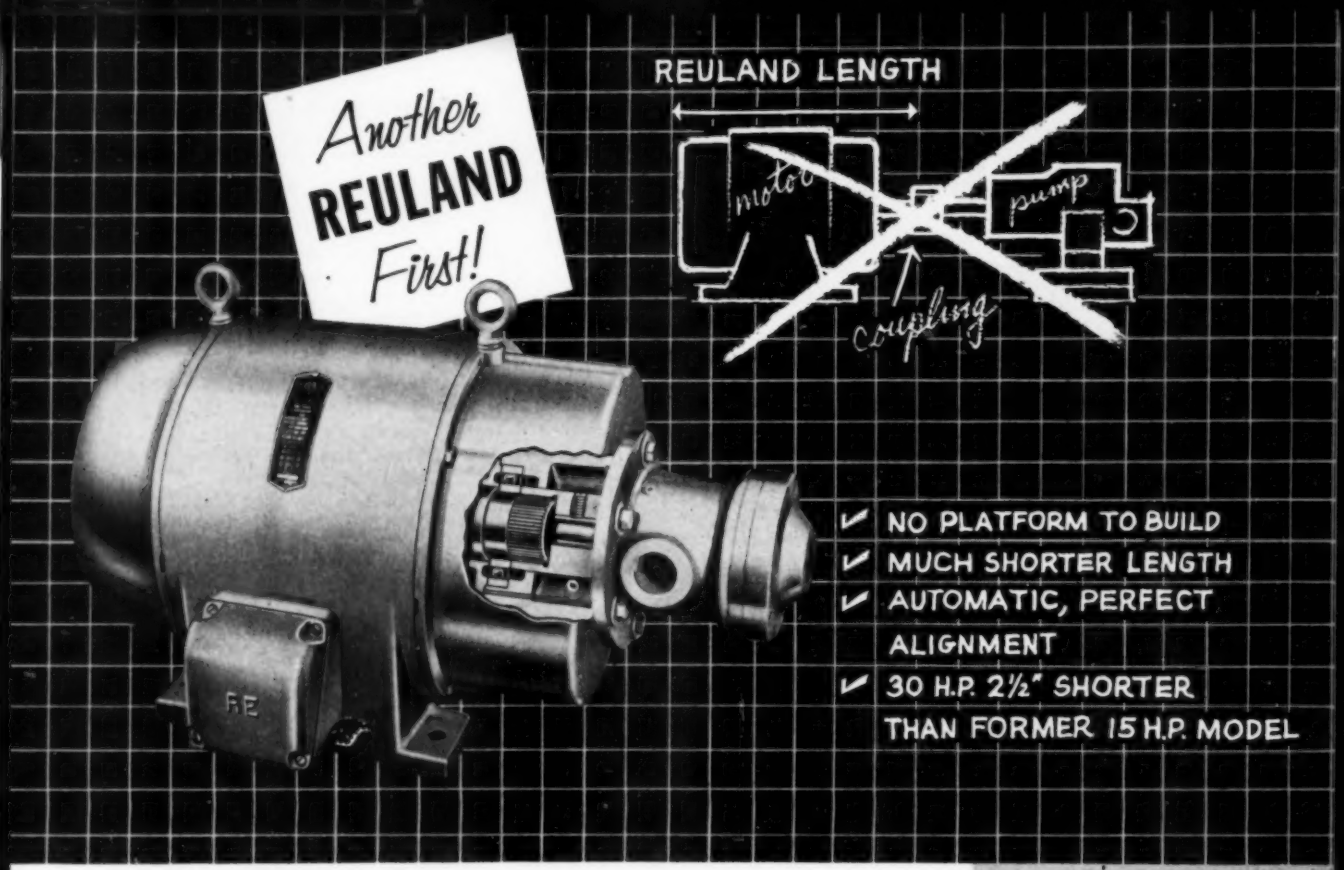
Servo Glossary

Aro, Inc., operates the Arnold Engineering Development Center for the U. S. Air Force. When complete, this Center will provide both private industry and Armed Forces with an adequate installation to test advanced designs of guided missiles, rocket and jet propulsion power plants, airframes and aircraft components.

Several of the instrument personnel in our test laboratories have found the "Servo Glossary" which appeared on page 75 of the May 1956 APPLIED HYDRAULICS of

Continued on page 14

Circle 31 on Reader Service Card



NEW, REULAND HYDRAULIC PUMP MOTOR features FAST, SPLINE-COUPLED hook-up!

Perfect alignment ...in 1/10th ordinary time

You can hook up a Reuland motor and any standard make hydraulic pump in a matter of only seconds. All you have to do is slip the spline coupling onto the motor's spline shaft and attach the pump flange to the endbell.

Absolutely perfect alignment is assured. There is no tinkering around with a mounting platform and your finished job always has a sleek, well-designed appearance. Takes only a tiny fraction of the ordinary time.

For all standard pumps

Regardless of the pump you are now using, you can adopt this exclusive new Reuland hook-up. If your pump is not a standard make we can quickly adapt to your setup. The Reuland method is so radically simple you will be amazed at the tremendous advantages.

Coupling supplied with motor

Buy a Reuland hydraulic pump motor and you need nothing more. Spline coupling and drilled-and-tapped endbell are supplied ready for immediate pump attachment. (Adaptable to either single or double end pump installations.)

Use these new Reuland motors and you will save platform mounting expense and alignment time. You achieve compactness and better looks *plus* longer pump life through factory engineered alignment. For FREE ENGINEERING LITERATURE please write for folder No. 1109.

Other Reuland firsts...

First FLUID-SHAFT MOTOR
(First with internal fluid coupling)
First ALL-ALUMINUM MOTOR FRAMES
First THROUGH-SHAFT MAGNETIC BRAKES
First FOOT-MOUNTED DISC TYPE MAGNETIC BRAKES
First SLIP RING MOTORS IN SMALL #66 FRAMES

REULAND MOTORS

REULAND ELECTRIC COMPANY

Western Division: Alhambra 49, California • Eastern Division: Howell 49, Michigan

Distributors in all principal cities

Circle 83 on Reader Service Card

Don't pay for special-motor development before you check Reuland's

Special-Motor Library

Hundreds of different and unique electric motors — one of which may already be made to order for your needs. Originally designed for special uses. Now available to help you save expensive development work and put you in production faster!

Write for free booklet on HOW TO USE the Reuland Library!

Free General Catalog of the COMPLETE Reuland Line of Standard and Special Motors sent on request

the NEW

USG SOLFRUNT®

(SOLID FRONT CONSTRUCTION)

the gauge with

BUILT-IN SAFETY!

There's safety with the new USG Solfrunt Gauge . . . behind the face is a solid metal wall! In the event of a Bourdon tube rupture, pressure is released through the large rubber blowout back. The case is of aluminum.

Like USG's Supergauge . . . with proper application . . . the Solfrunt is built to last a lifetime.

ARC-LOC MOVEMENT—Rugged beyond compare . . . broad generated gear faces, deep stainless steel bushings. Calibration adjustments from rear by merely removing blowout back.

SEGMENT—Stainless steel, with nylon-faced gear section. Nylon-to-metal bond stabilizes the nylon against expansion and contraction . . . maintains accurate pitch diameter . . . assures proper mesh with stainless steel pinion under severe temperature and moisture conditions.

LEGEND ON DIAL—gives complete description of socket, Bourdon tube, and movement material for ready identification.

MICROMETER ADJUSTABLE SELF-LOCKING POINTER—permits accurate repositioning of pointer.

Solfrunt Gauges available in 4½", 6" and 8½" sizes. For complete information on case styles, materials of construction and connections, write for Publication 1819.

USG

UNITED STATES GAUGE

Division of American Machine and Metals, Inc.

Sellersville, Pa.

Home of the SUPERGAUGE

LETTERS to the editor

interest and have expressed a desire for copies for personal retention. With your permission we would like to reproduce a limited number of copies of this glossary so that we might give each instrument engineer a copy for his file.

G. E. RANDALL
Manager, Technical Information Branch
Aro, Inc.
Tullahoma, Tennessee

We're pleased to give you permission to make copies of the "Servo Glossary" for your instrument engineers.

Reprints Available

We have found your excellent magazine very useful over these past several years. Unfortunately we have not had the heart to clip out the articles on Fluid Power Circuits and Pneumatic Circuits before sending on the magazines to the other members of the staff. We would appreciate having the reprint booklets of these two series.

Also may we have a copy of Component Application Sheets for Fluid Power Equipment by Mr. Rolnick.

HOWARD G. ANSON
Ass't Chief Engineer
Graystone Inc.
Seattle, Washington

We appreciate your very nice comments about AH. Copies of "Component Application Sheets" and "Beginners Course in Basic Pneumatics" have been sent to you. Sorry, the publication "Fluid Power Circuits" is out of print.

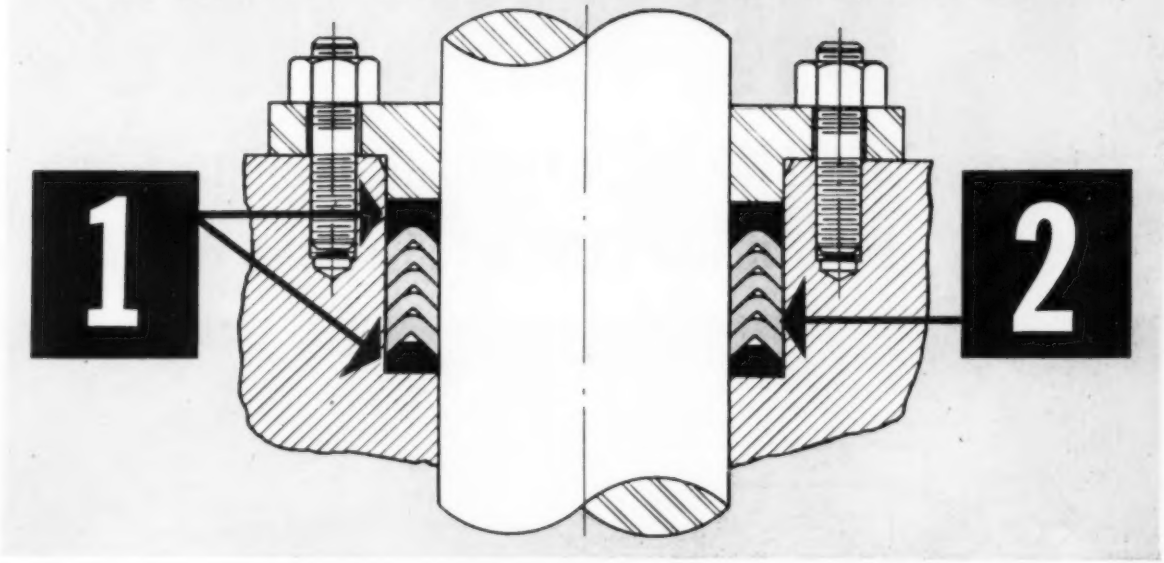
Engineering Index

I am giving a talk on "Hydraulics" to a group of 25 engineers. The list of technical publications on fluid power that you have compiled would be of great interest to them. Can I get copies?

W. J. H. MURPHY
Associate Research Engineer
Armour Research Foundation
Chicago, Illinois

Copies of the Fluid Power Engineering Index, which is the January 1956 *issue of* APPLIED HYDRAULICS *are available.* ▼▼▼

TWO NEW HOUGHTON "V" PACKING DEVELOPMENTS



SAVE TWO GLAND DESIGN JOBS

1

2

Houghton's new molded "V" Packing adapters do away with individually designed metal support rings. And besides saving you design work, they help "V" Packings make a better seal.

These molded rings can "give" under pressure, expanding to bridge the clearance. They'll flex without cracking. They're not subject to the fatigue that can break down metal rings. Because they expand along with packings Houghton Molded "V" Packing adapters provide better support and permit packings to give longer service.

Standard stack heights of Houghton "V" Packings give designers a break, too. When you use Houghton "V's" you don't need to design glands differently because packings of different materials will be used in them. Just figure the number of packings pressure requirements demand . . . then allow for the dimension in your design. Whether you use rubber, fabricated rubber, or leather "V's" . . . they'll fit. They are all the same stack height.

There's more than 50 years of hydraulic know-how behind these new design developments. They're typical of Houghton's complete line of hydraulic and pneumatic packings and hydraulic oils and fluids. For the full story, call your Houghton Man today—or write E. F. Houghton & Co., 303 West Lehigh Avenue, Philadelphia 33, Pa.

"V" PACKINGS

. . . products of

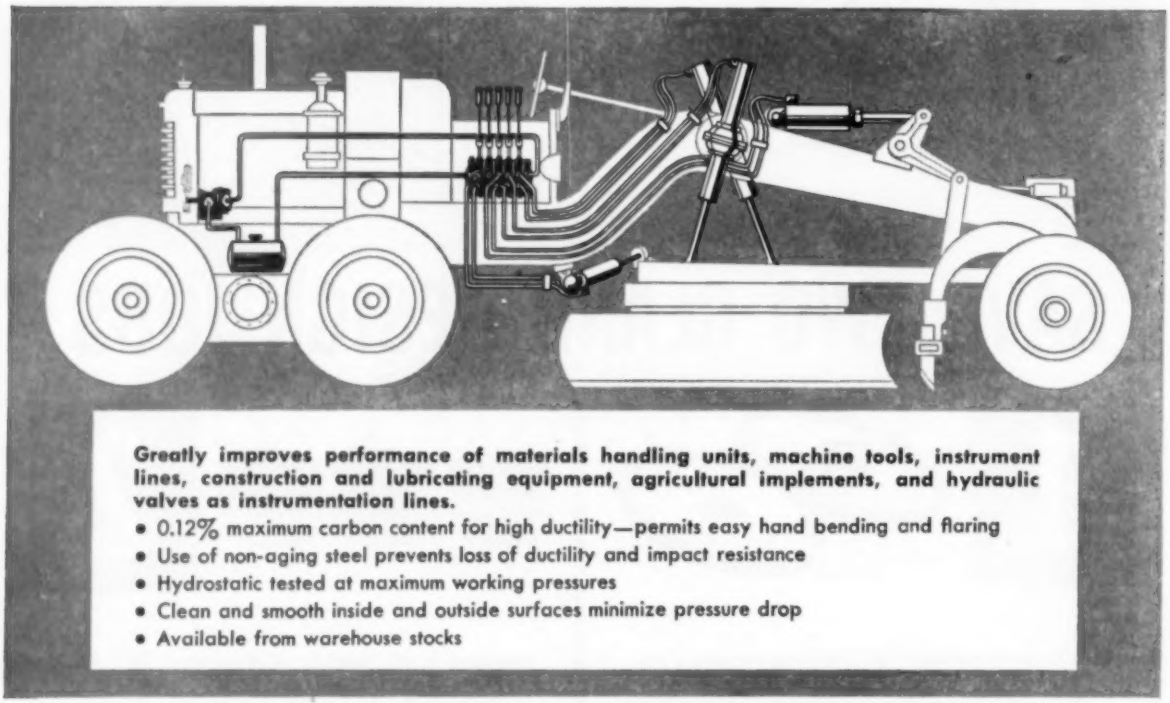
E. F. HOUGHTON & CO.

PHILADELPHIA · CHICAGO · DETROIT · SAN FRANCISCO

Ready to give you on-the-job service . . .

5 BIG REASONS

SUPERIOR SAE HYDRAULIC TUBING PRACTICALLY ELIMINATES TUBING FAILURE



Greatly improves performance of materials handling units, machine tools, instrument lines, construction and lubricating equipment, agricultural implements, and hydraulic valves as instrumentation lines.

- 0.12% maximum carbon content for high ductility—permits easy hand bending and flaring
- Use of non-aging steel prevents loss of ductility and impact resistance
- Hydrostatic tested at maximum working pressures
- Clean and smooth inside and outside surfaces minimize pressure drop
- Available from warehouse stocks

This motor grader is one of the many types of mechanized equipment that use Superior SAE Hydraulic Low Carbon Steel Tubing.

Superior SAE Hydraulic Low Carbon Steel Tubing is made from a carefully controlled non-aging type of steel which will not harden in storage or use. Aging and precipitation hardening are changes in properties that some steels undergo at atmospheric or moderately elevated temperatures after cooling or cold working. These take place even where steel is stored at room temperature, though at a slower rate.

Superior SAE Tubing, whether in storage or operation, will maintain the yield strength, elongation and ductility it has when shipped from the mill.

Superior SAE Hydraulic Tubing is available from distributor warehouse stocks or mill produced to your order in long coils.

Send for a copy of Bulletin 39, containing detailed information on the uses and advantages of Superior SAE Hydraulic Tubing. Write Superior Tube Company, 2030 Germantown Ave., Norristown, Pa.

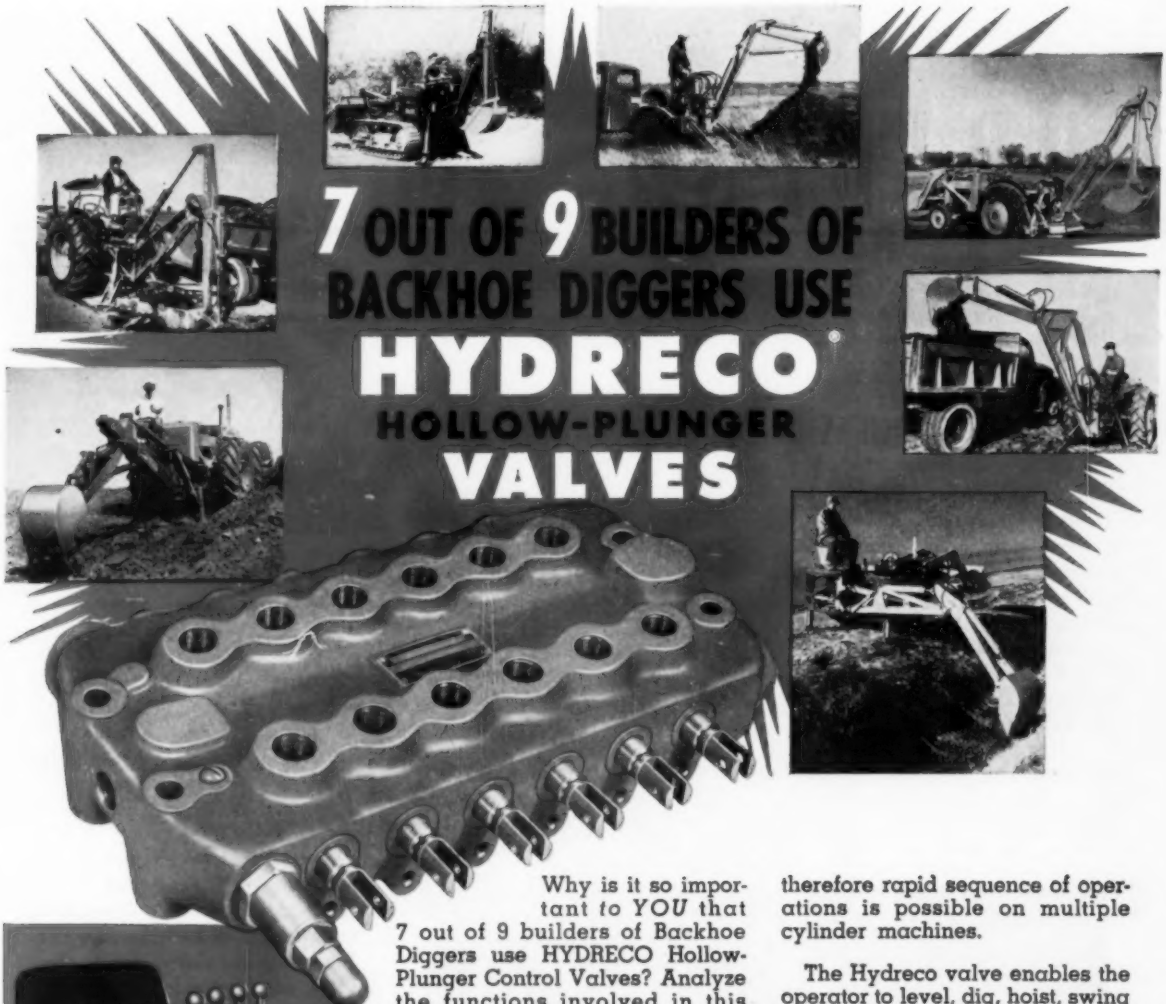
Superior Tube

The big name in small tubing

NORRISTOWN, PA.

All analyses .010" to ½" OD—Certain analyses in light walls up to 2½" OD

On the West Coast: Pacific Tube Company, 5710 Smithway St., Los Angeles 22, Calif.



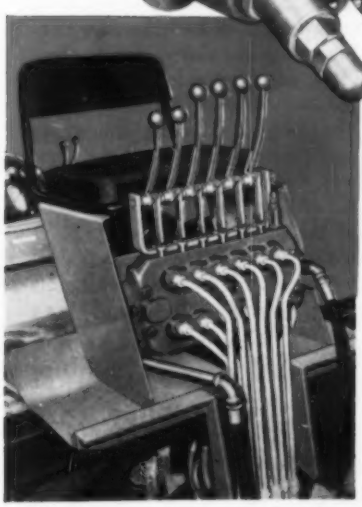
7 OUT OF 9 BUILDERS OF BACKHOE DIGGERS USE HYDRECO® HOLLOW-PLUNGER VALVES

Why is it so important *to YOU* that 7 out of 9 builders of Backhoe Diggers use HYDRECO Hollow-Plunger Control Valves? Analyze the functions involved in this Fluid Power application, and the answer is clear. Here is a rugged service application requiring multiple manual control of Fluid Power operations, good throttling, and easy-to-reach controls. All these features are combined in Hydreco Hollow-Plunger Valves to give the operator a feeling of "playing" the machine.

Hydreco Hollow-Plunger valves are perfect for this application. Check valves built into the plungers absolutely prevent back flow and cross flow between cylinders, therefore rapid sequence of operations is possible on multiple cylinder machines.

The Hydreco valve enables the operator to level, dig, hoist, swing and dump quickly and easily. The operator has the touch he needs to get the best out of a good machine, day in and day out. That's why operators like Hydreco Hollow-Plunger Valves.

Designers like Hydreco valves too, because with all components built in, they come smaller and fit into tight places more easily. For smoother operation, for more work at less cost — apply HYDRECO Hollow-Plunger Valves to your multiple-function equipment!



Hydreco valves are available with up to 6 plungers.

Member NFPA

KALAMAZOO DIVISION
THE NEW YORK AIR BRAKE COMPANY

9004 E. MICHIGAN • KALAMAZOO • MICH.
INTERNATIONAL SALES OFFICE, 90 WEST ST., NEW YORK 6, N. Y.

Kalamazoo Division
The New York Air Brake Company
9004-8 East Michigan
Kalamazoo, Michigan

Kindly send me full information on Hydreco Hollow-Plunger Control Valves.

Name_____

Company_____

Address_____

City_____ Zone_____ State_____

BRIEFS about fluid power

HYDRAULICS SIMPLIFIES DREDGING OPERATIONS

To provide better drainage of Friendship International Airport near Baltimore, a new canal, three quarters of a mile long, has been dredged with a small hydraulic dredge.

Ellicott Machinery Corporation designed and constructed this equipment, the Canal Dragon, a 6 inch swinging ladder-type dredge. Use of hydraulics provides easier operation with increased variable speed control and eliminates the cumbersome mechanical drives such as pulleys, drums and bull gears, previously used on such equipment. The unit has a rated output of about 80 cubic yards per hour of dredged material.

All operations of the unit—cutter, spuds, ladder and directional control of the discharge pipe—are hydraulically actuated. One hydraulic pump, five fluid motors and nine hydraulic cylinders make up the circuit. Motors and cylinders are controlled by two double acting valves. These valves are connected to control levers on a console-type panel, designed for one-man operation.

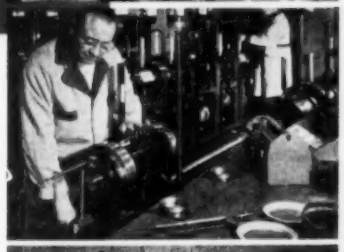
Power is supplied by a 60 hp Diesel engine. A double vane-type pump, connected directly to the drive shaft of the diesel engine provides a system pressure of 2000 psi. A fluid motor is connected by a gear reducer to the inboard end of the cutter drive shaft, which runs the entire inside length to the ladder. Forward and reverse motion and speed of the cutter are infinitely controlled by a single lever connected to one of the double acting valves. Double acting cylinders, connecting to each side of the inboard end of the ladder actuate the direction of swing. Each of the three positioning spuds are raised and lowered by a winch connected to a gear reducer through a fluid motor. The two positioning spuds are also raised and lowered the same way, but a double-acting cylinder is used for changing the position of the dredge. Double-acting cylinders also actuate the lateral swing and the vertical positioning of the discharge pipe. ▼▼▼

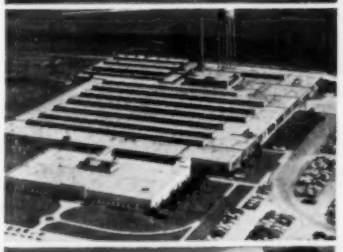
Fluid Power On The Move

We thought we caught up with our childhood again when we visited the Material Handling Institute's Exposition in Cleveland in early June. We were again able to pull handles, press buttons and watch equipment go up, down, sideways, turnover—and all with fluid power. Here are some of the

Continued on page 21

Here's how C/R COOPERATIVE RESEARCH *can help you*





HELP YOU ENGINEER YOUR PRODUCT, ELIMINATE TOUGH TROUBLE SPOTS AND SAVE YOU MONEY IN FLUID SEALING AND RELATED FIELDS

Developing a new product or rectifying trouble in a present one? Why not supplement your own engineering facilities with C/R Cooperative Research? In the areas related to oil seal design, lubricant, chemical, gas, or air retention, and foreign matter exclusion—as well as in the development of synthetic rubber and impregnated mechanical leather parts—Chicago Rawhide's developmental facilities are the most extensive in the country.

All of them are at your service . . . for help with your critical or unusual problems. You may be sure that your design specifications, performance requirements, and production controls will be met to the letter. A few of the many ways in which C/R Cooperative Research serves other leading manufacturers are pointed out on this page. We'll be glad to help you.

INFORMATION . . . Comprehensive brochures and catalogs are available to give you the complete scope of C/R products and services. Write for your copies, and please indicate your area of interest.

DESIGN . . . When your product is on the drawing board is the time to correlate design and materials with performance requirements. C/R's expertly-staffed engineering groups working in close cooperation with the material labs have done it for others . . . and can do it for you.

MATERIALS . . . Pioneers in the development of Sirvis (mechanical leather) and Sirvene (synthetic rubber) parts for oil seals and other mechanical applications, C/R will custom-develop materials for your special needs in our synthetic rubber or leather laboratories.

PRODUCT TESTING . . . Many products, new and present, need extensive checking. C/R testing labs often work many months to verify designs, eliminate trouble. This is standard procedure on all C/R stock products . . . essential in developing yours.

TROUBLE SHOOTING . . . Auto and heavy equipment makers, as well as manufacturers in most fields you can think of, have solved difficult sealing and related problems with the help of C/R Cooperative Research. You can, too . . . and save time, trouble and money.

PRODUCTION . . . Six plants, operating as extensions of C/R Cooperative Research, provide laboratory-like quality control, timed to your needs. C/R Sales Engineering follows through to coordinate and assure satisfaction.

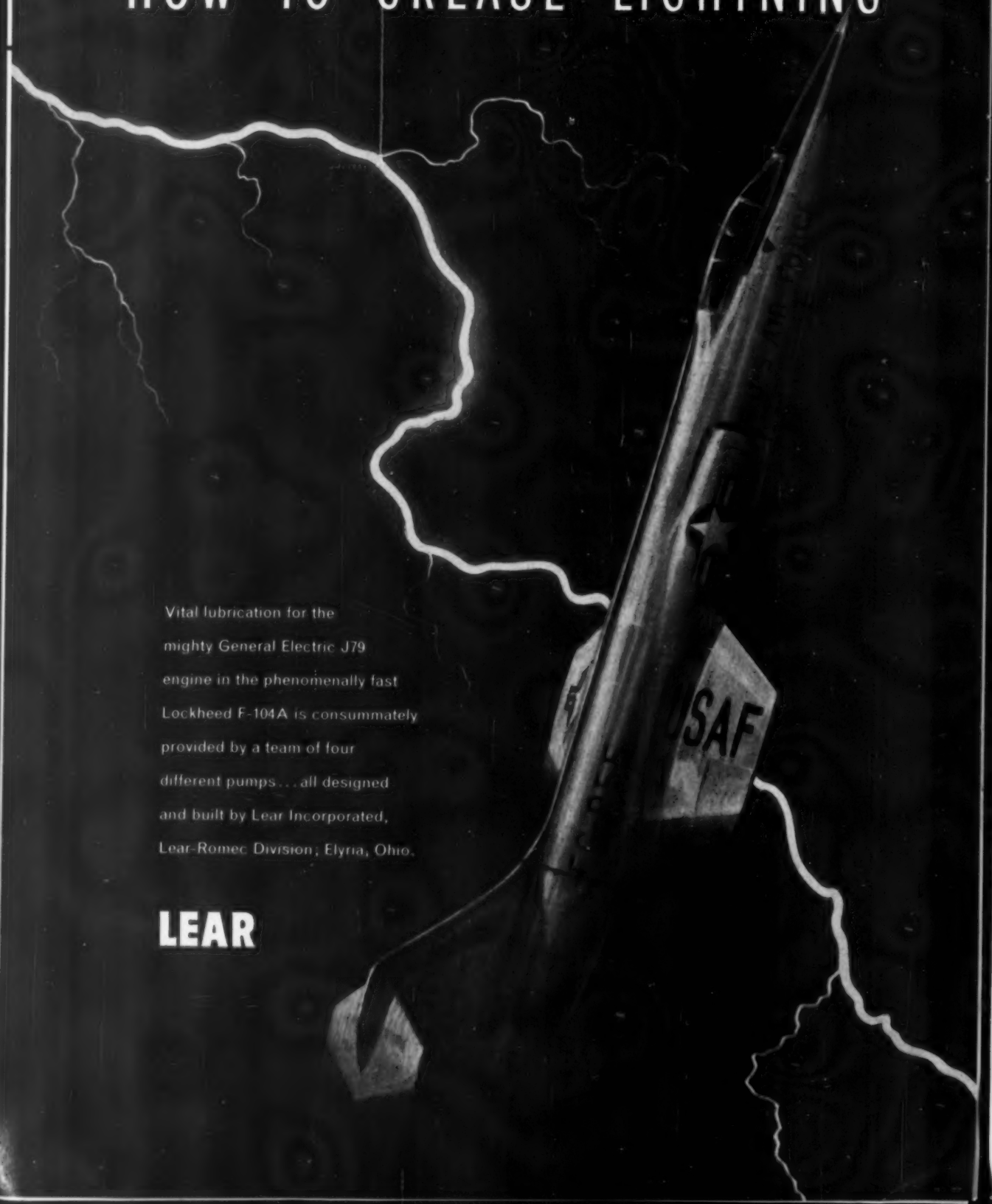
EXPERIENCE . . . Broadest in the field. Proof? More automobiles, farm equipment and industrial machines rely on C/R Oil Seals than on any similar sealing device. C/R diaphragms, boots and gaskets are in the same top categories.

C/R

CHICAGO RAWHIDE

CHICAGO RAWHIDE MANUFACTURING COMPANY
1203 Elston Avenue, Chicago 22, Illinois
Offices in 55 principal cities
In Canada: Super Oil Seal Mfg. Co., Ltd., Hamilton, Ontario
Export Sales: Coon International Corp., Great Neck, New York
C/R Products
C/R Shaft & End Face Seals • Sirvene (synthetic rubber) molded shields parts
• Sirvis (Super reinforced leather cups, packings, boots • C/R Bal-centric Seals

HOW TO GREASE LIGHTNING



Vital lubrication for the mighty General Electric J79 engine in the phenomenally fast Lockheed F-104A is consummately provided by a team of four different pumps... all designed and built by Lear Incorporated, Lear-Romec Division, Elyria, Ohio.

LEAR

Are you the engineer who can move in fast company?

If you're the sort of engineer who's happiest when he's setting the pace, you might do well to scan the list of jobs now open at Lear—a company that's blazed the way in filling the precision needs of aviation. You will receive a prompt reply by writing to Don Cook, Dept. E-4, 3171 South Bundy Drive, Santa Monica, Calif. Excellent openings available in Grand Rapids, Michigan; Cleveland, Ohio; Arizona; Santa Monica, California.

Aerodynamics
Aeronautical design
Aircraft electrical systems
Automatic flight controls
Computers
Communications (aircraft)
Electro-mechanics
Electronic packaging
Flight reference systems
Flight instrumentation
Fractional H. P. motors
Gyroscopes
Hydraulic systems
Magnetic amplifiers
Missile controls
Navigation systems (aircraft)
Process engineering
Pumps (aircraft and industrial)
Quality control
Radar
Servo mechanisms
Systems analysis
Test equipment design
Transistorized circuitry

LEAR

BRIEFS continued

many applications we saw, where fluid power has helped to keep industrial production on the move.

A self-starting, self-leveling loading dock was demonstrated by Field Engineering Co. A hinged ramp rests at an angle on the truck. When the front wheels of a

Compact power package uses minimum of space below the self-starting, self-leveling platform.

fork truck touch a switch located in the center of the platform, it starts the hydraulic pump-motor, which pumps oil into the lifting cylinder to raise the platform to the required height. When lift truck is unloaded and run back onto the platform, the switch is again struck from the opposite direction. It actuates a solenoid operated valve which permits oil to flow from the cylinder. The platform is lowered till the switch on the dock-end breaks the circuit.

A new hydraulic control valve was shown for the first time by the Kalamazoo Division of the New York Air Brake Company. This new valve has a pilot operated re-

Walter Root, sales promotion manager of Kalamazoo Division, demonstrates new hydraulic valve for mobile equipment.

lief and unloading valve and positive-control cylinder checks, all incorporated in a common housing. The unit is rated at 20 gpm, 2000 psi maximum operating pressure. The pressure setting of the relief valve is fully adjustable throughout the entire range.

The largest paper roll grab so far developed was shown by Cleveland Tramrail Division of The Cleveland Crane & Engineering Co. It handles rolls up to 6000 lbs. and of diameters from 24 to 62 inches. The unit employs a turnover mechanism which permits a

Roll grab picks up paper roll from horizontal position. Hydraulic cylinders adjust the clamps.

Power package can be seen located in head of crane. The giant cylinder operates the grab arm.

roll to be picked up in any position and placed in any position. The grippers of the clamps are hydraulically operated and a giant clevis-mounted cylinder controls the grab motion. The complete power package is located in the head of the crane.

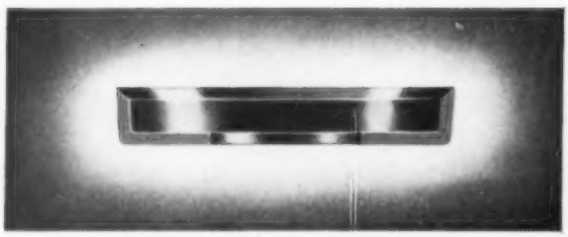
Several made-to-scale models of Dempster Dumpsters were in operation. This equipment—which consists of one truck and different types of containers—is being used in practically every field of bulk materials handling. One man can control all operations from the

Continued on page 24

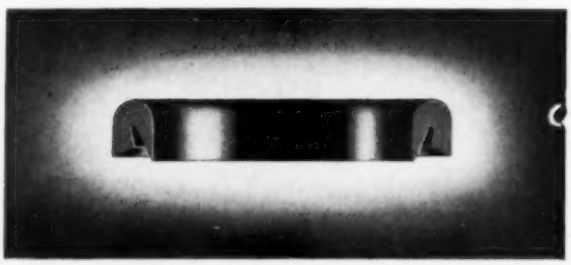
← Circle 60

Simplify your sealing problems...

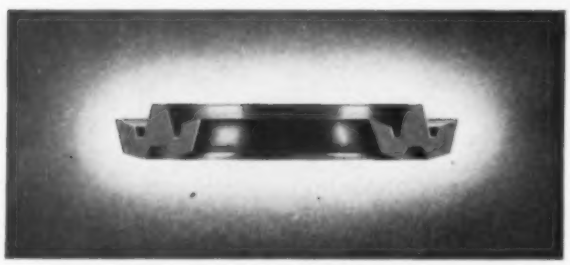
with Johns-Manville Precision moulded packing designs for pressure applications in hydraulic and pneumatic equipment



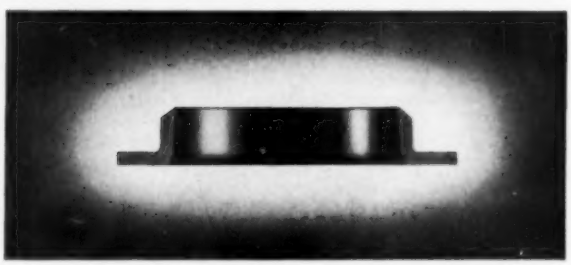
1. Type "A" Packing Cups for pistons
(the original "square heel" cup design)



2. Sea Ring packing for rods

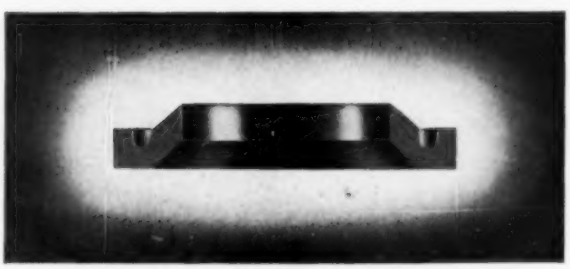


3. Uneepac Packing for rods and pistons

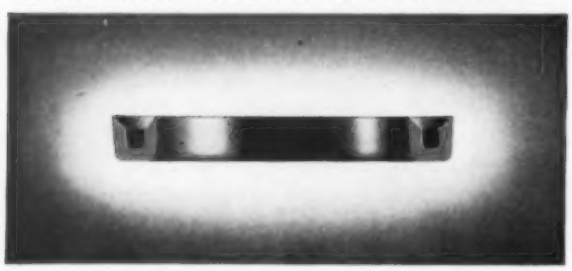


4. Hat Cup Packing for rods

5. V-Rings packing for rods and pistons



6. Cumpac #239 packing for rods



7. U-Cup Packing for rods and pistons

THE WIDE VARIETY of Johns-Manville Packing designs enables you to handle practically any sealing problem. The designs shown on this page are obtainable in a broad range of standard sizes and in materials designed for either usual or special service conditions encountered in hydraulic and pneumatic equipment. Johns-Manville also produces oil seals, moulded gaskets and miscellaneous shapes to specification. See your local J-M distributor or J-M sales office for product or engineering data. Or write Johns-Manville, Box 60, New York 16, N.Y. In Canada, Port Credit, Ontario.

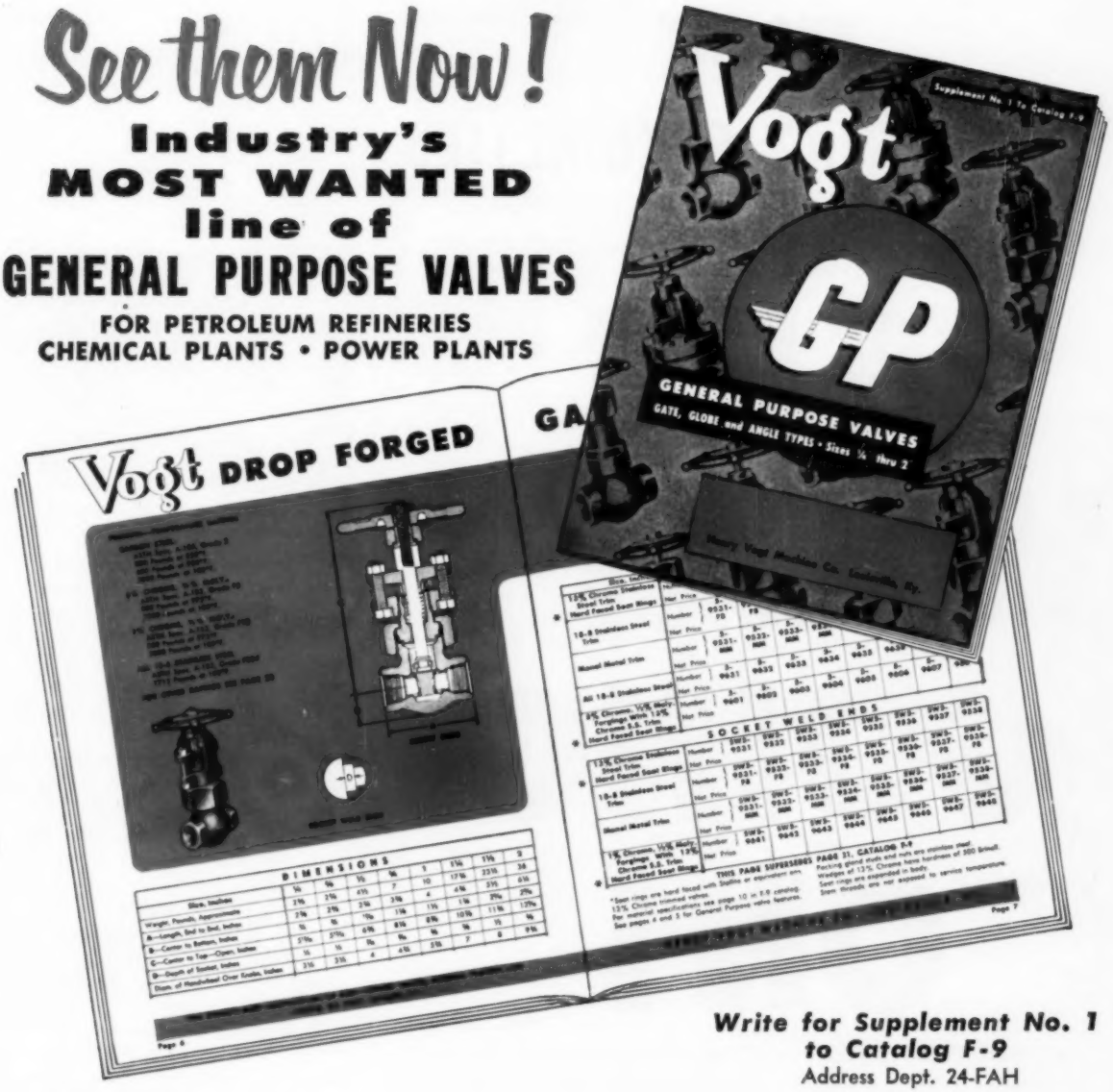
JOHNS-MANVILLE JM PRODUCTS

Johns-Manville MOULDED PACKINGS

See them Now!

Industry's MOST WANTED line of GENERAL PURPOSE VALVES

FOR PETROLEUM REFINERIES
CHEMICAL PLANTS • POWER PLANTS



Write for Supplement No. 1 to Catalog F-9
Address Dept. 24-FAH

MOST WANTED — that's right — because the G P line includes gate, globe, and angle type valves having seats faced with **HAYNES STELLITE*** alloy or other hard facing alloys for greater seat-wear resistance . . . at no extra cost!

Hard faced seats, in combination with precision finished, selectively hardened discs and wedges give these valves amazing resistance to erosion, corrosion and galling. That's why they are setting new standards of performance in steam, water, oil, or gas services at the recommended pressures and temperatures.

Get longer, drop-tight, service life with minimum maintenance by specifying Vogt G P Valves. Available in a complete range of sizes from ¼" to 2" and rated 800 pounds at 850°F. and 2000 pounds at 100°F.

HENRY VOGT MACHINE CO.
P. O. Box 1918—Louisville 1, Ky.

SALES OFFICES: New York, Chicago, Cleveland, Dallas, Philadelphia, St. Louis, Charleston, W. Va., Cincinnati, San Francisco

Vogt GENERAL GP PURPOSE — Vogt FOR BETTER VALVES

DROP FORGED STEEL

VALVES

*Trade-Mark of Union Carbide and Carbon Corporation

NUGENT

LUBRICATING SPECIALTIES LET YOU SEE WHAT'S GOING ON!

- **SIGHT FEED VALVES** provide a means of regulating and visually checking oil flow at the point of delivery to bearings, gears, etc.
- **SIGHT FLOW INDICATORS** tell you at a glance, or by the sound of an alarm bell, whether or not oil is flowing properly to vital parts.
- **MULTIPLE OILERS** are furnished in a variety of types with any number of feeds and will materially reduce lubrication costs for machinery with many enclosed or hard-to-get-at bearings.

Nugent manufactures a complete line of lubricating specialties. Write for descriptive literature mentioning the type of equipment you are interested in.

NUGENT TRADE MARK

Wm. W. Nugent & Co., Inc.
3432 Cleveland St. Skokie, Illinois

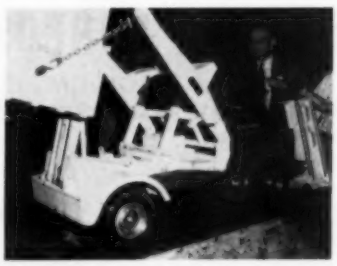
Established 1897

OIL FILTERS, OILING AND FILTERING SYSTEMS, TELESCOPIC OILERS, OILING DEVICES, SIGHT FEED VALVES, FLOW INDICATORS

Representatives in Boston • Cincinnati • Detroit • Houston • La Junta, Colo. • Los Angeles Minneapolis • New Orleans • New York • Philadelphia • Portland, Ore. • San Francisco Seattle • St. Louis • Tulsa • Representatives in Canada: Montreal • Toronto • Vancouver

BRIEFS continued

driver's seat. The operating unit is essentially a subframe and three hydraulic cylinders, one boom assembly and one carriage. Two of



Ease of operation is shown on a Dempster Dumpster scale model.

the hydraulic cylinders raise and lower the boom, the third moves the carriage forward and rearward. The cylinders are controlled by a multiple valve which is operated from the cab.

For palletless materials handling, Cascade Manufacturing Company offered a hydraulically actuated clamp attachment for lift trucks, known as Load-Grab. The unit consists of a frame, arm carriers, cylinders and a check valve. The cylinders have a stud-end type mounting which provides a self aligning feature for non-binding operation. The cylinders are designed for operating pressures up to 2000 psi.

Hydraulic components used in the operation of mobile equipment were connected to miniature

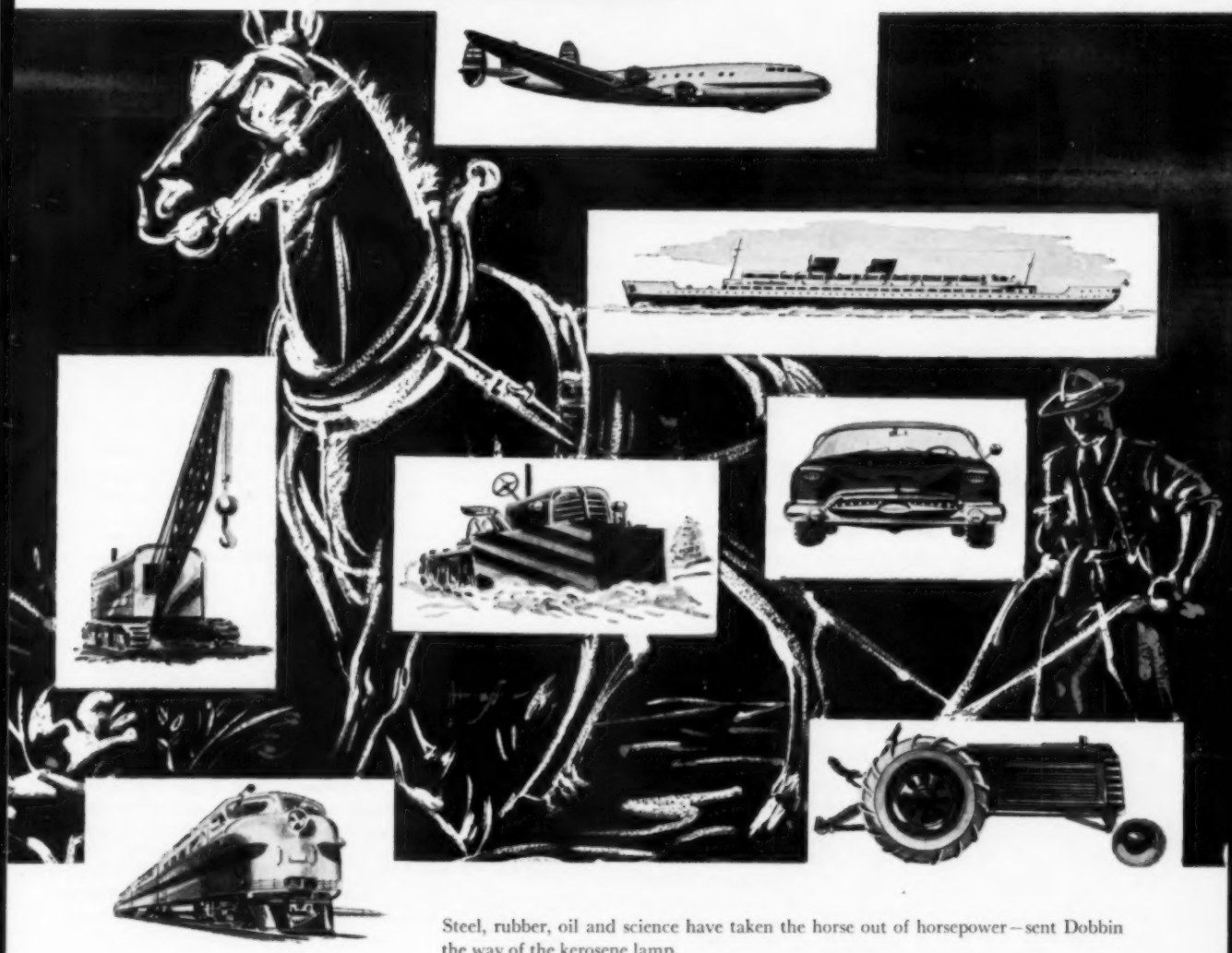
Gadzooks—the valves are bigger than the machines they control. Visitors to this display operated full size hydraulic controls and saw the resultant motions.

models on a display stand by Vickers Incorporated. There we could operate a tractor loader, a lift truck and a post hole digger to our heart's delight.—We did. ▼▼▼

Continued on page 26

Circle 72 on Reader Service Card

Naugatuck Paracril



the new horsepower needs oil-resistant Paracril!

Steel, rubber, oil and science have taken the horse out of horsepower – sent Dobbin the way of the kerosene lamp.

The *new* power is OIL – oil that burns – oil that transmits silent fluid power in hydraulic systems – oil that lubricates moving parts.

And PARACRIL* is the modern oil-resistant chemical rubber that's outstanding for its ability to control the power of oil – in gaskets, seals, hydraulic hose and similar applications.

Highly resistant to animal, vegetable and mineral oils, fats and greases, PARACRIL also provides excellent *abrasion resistance*, good *flexibility* over a wide temperature range, great *dimensional stability* and lasting *resilience*. That's why this Buna-N (nitrile-type) rubber made by Naugatuck Chemical is more and more in demand by manufacturers of rubber products that operate in contact with oil.

Remember the name PARACRIL whenever you think of maximum oil-resistance in rubber. It's your best assurance of long, trouble-free performance in pressure seals, hydraulic hose and accumulator bladders.

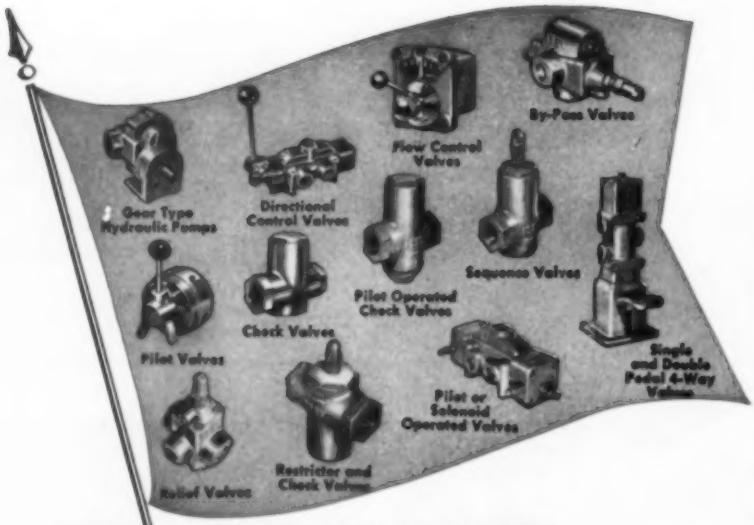
***PARACRIL is Naugatuck Chemical's registered trademark for its Buna-N (nitrile-type) synthetic rubber.**

Naugatuck Chemical

Division of United States Rubber Company
Naugatuck, Connecticut

IN CANADA: NAUGATUCK CHEMICALS, Elmira, Ontario • Cable Address: Rubexport, N.Y.
Rubber Chemicals • Synthetic Rubber • Plastics • Agricultural Chemicals • Reclaimed Rubber • Latices

Circle 104 on Reader Service Card



BY ANY STANDARD...

ADEL *Refinements* assure Plus Performance for Your Equipment

Designers and Engineers have set these standards for Industrial Hydraulic Equipment

Rugged simplicity • Long life • Simplification of piping • Reduced installation costs • Greater accessibility for maintenance • Completeness of line • Over-all economy

ADEL brings them all to you!

Smooth economical hydraulic power for Pushing, Pulling, Lifting, Pressing, Clamping and Controlling.

Illustrated are but a few of a wide variety of ADEL industrial hydraulic control equipment that offer definite benefits to both the user and builder of machine tools and many other kinds of equipment. ADEL products incorporate proven design and precision construction features that assure dependable operating efficiency over the years. A complete line for every application. You can simplify your Hydraulic Power Motion Problems by specifying ADEL.

For complete engineering specifications and counsel, Address: ADEL DIVISION, GENERAL METALS CORPORATION, 10771 Van Owen Street, Burbank, California

ADEL
PRECISION PRODUCTS
A DIVISION OF GENERAL METALS CORPORATION

Manufacturers of Industrial Hydraulic Control Equipment

DISTRIBUTORS: AIR-DRAULIC EQUIPMENT CO., HOUSTON, TEX. • AIR & HYDRAULIC ENGINEERING CO., NEW HAVEN, CONN. • RUSS CHAMBERLIN COMPANY, PORTLAND 14, ORE. J. BOYD COATES, GLENSIDE, PA. • CORBY SUPPLY COMPANY, ST. LOUIS, MO. • FRANK T. DONNELLY COMPANY, PITTSBURGH 38, PA. • HASKEL ENGINEERING & SUPPLY CO., GLENDALE 4, CALIF. • HASKEL ENGINEERING & SUPPLY CO., SAN FRANCISCO 7, CALIF. • AIR-DRAULICS COMPANY, PHOENIX, ARIZ. • INDUSTRIAL AIR & HYDRAULIC EQUIP. CO., DETROIT 15, MICH. LINCOLN SUPPLY COMPANY, PROVIDENCE, R. I. • L. H. MONSEES, INDEPENDENCE, MO. • THE NEFF ENGINEERING CO., FORT WAYNE 3, IND. • POWER DRIVES, INCORPORATED, BUFFALO, N. Y. • SCOTT EQUIPMENT & ENGINEERING CO., DAYTON 10, OHIO • ROBERT TAYLOR & SONS, SALT LAKE CITY 10, UTAH • WYATT SALES COMPANY, CLEVELAND 15, OHIO TRI-STATE SUPPLY COMPANY, BROOKLYN 33, N. Y.

BRIEFS continued

Tractor Operation Remote Controlled

A radio-controlled tractor was recently demonstrated by the Ford Motor Company's Farming Center in Boreham, England.

A small control box, which transmits radio signals to the equipment, controls right and left turns, raising and lowering of attachments, clutch operation and fuel cut-off mechanism. For executing the control movements a hydraulic system at a pressure of 500 psi is maintained. A magnetic bypass valve included in the system short circuits the pump when no hydraulic power is required. ▼▼▼

A number of these 10 ton Pettibone-Mulliken motor graders are used by the Los Angeles County to maintain their roads. They drive a 12 foot blade with more than a 100 horsepower. Use of series multiple plunger valves permit moving the heavy blade in increments as fine as 1/8 inch and with positive control and no danger of drop or shift.

Recent Publications

Applied Automation: Edited by James Custer. Published by Chilton Publications, Philadelphia. 235 pages, illustrated. Price: $6.00.

This volume describes in detail over 101 specific applications in a wide range of industries including automotive, aviation and other manufacturing fields. It outlines the continued technological progress which has accelerated interest in the approach of the continuous automatic production line. Among the many operations listed are machining, plating, welding, testing, assembling, casting, control systems and many others. ▼▼▼

Continued on page 29

In
American Tractor's
Terraloaders...

Webster Hydraulic Pumps for Shock Resistance

Watch the operator of an American Tractor TERRALOADER drive the bucket deep into a pile of rubble . . . see the ease and speed with which the hydraulically operated bucket lifts its brimming load . . . and you can't help but marvel that a piece of equipment can withstand such day-after-day abuse.

One small, but important, factor in Terraloader's fine performance is the WEBSTER Type HC hydraulic pump.

The ability of this pump to resist shock, its speed of response, its compact size and its rugged dependability, make it the ideal unit for such applications.

The Type HC is just one of a complete line of more than 100 WEBSTER hydraulic pumps and motors. Pumps range in capacity from 1/5 to 30 gpm, at pressures up to 1500 psi and speeds to 3600 rpm. Motors range up to 20 hp at 2000 rpm. Select from these the type that fits your needs with full assurance of fine performance and modest cost.

OIL HYDRAULICS DIVISION

WEBSTER RACINE **ELECTRIC** WISCONSIN

FREE 12-PAGE CATALOG

contains complete information on WEBSTER'S complete line of over 100 different positive displacement gear-type pumps and fluid motors. Write for your free copy today.

WEBSTER ELECTRIC COMPANY
Racine, Wisconsin

Please forward a copy of Bulletin H3A1.

Name_____

Title_____

Company_____

Street_____

City, Zone & State_____

MANUFACTURERS OF A COMPLETE LINE OF OIL HYDRAULIC PUMPS FROM 1/5 TO 30 GPM CAPACITY

over 8,000 Different Cylinder SELECTIONS—

Miller AIR AND HYDRAULIC CYLINDERS AND BOOSTERS "IN STOCK" for immediate delivery.

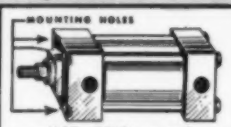
See Miller Bulletins A-105K (Air) and H-104K (Hydraulic) for Complete Dimensions and Engineering Data on these "in-stock" sizes and other Custom Miller Cylinders in bores up to 20" and strokes up to 22 feet.

"IN-STOCK" MODELS

"A" Signifies Miller 200 psi Air Cylinders; "H", 2000 psi Hydraulic Cylinders. Interchangeable Mountings Are Shown In Red On Drawings.

A61 and H61
Flange Mounting on Rod End
(A61 not available in 8" bore)

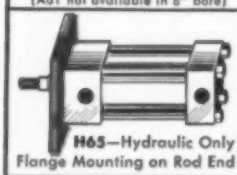
A62 and H62
Flange Mounting on Cap End
(A62 not available in 8" bore)



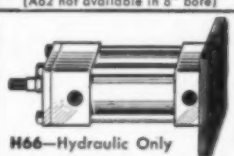
A63—8" Bore only
Flange Mounting on Rod End

A64—8" Bore only
Flange Mounting on Cap End

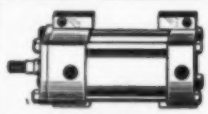
A50 & H50—Tie Rods not extended beyond nuts.
A51 & H51—Tie Rods extended both ends (shown).
A52 & H52—Tie Rods extended. Cap End only.
A53 & H53—Tie Rods Extended. Rod End only.
A54 & H54—Two Tie Rods extended at both ends.



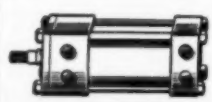
H65—Hydraulic Only
Flange Mounting on Rod End



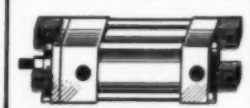
H66—Hydraulic Only
Flange Mounting on Cap End



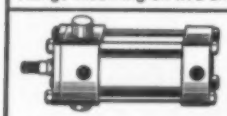
A72 and H72
Side Lug Mounting



A74 and H74
Side Flush Mounting



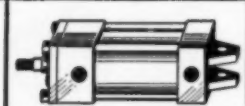
A77 and H77
Side or Foot Mounting



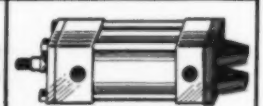
A81 and H81 Trunnion Mounting on Rod End

A82 and H82 Trunnion Mounting on Cap End

A83 and H83 Trunnion between Head and Cap (one week delivery)



A84 and H84
Pivot Mounting



A86 and H86
Pivot Mounting

IN STOCK BORES in Inches — "IN-STOCK" STROKES (in Inches)

	Bores	Rod Dia.	Rod Turn Down & Threads		1	2	3	4	5	6	7	8	9	10	11	12	14	16	18	20	22	24	28	32	36
AIR	1½	⅝"	7/16-20	Cushioned			3	4	5	6	7	8	9	10	11	12									
				Non-Cush.	1	2	3	4	5	6	7	8	9	10	11	12									
	2	⅝"	7/16-20	Cushioned			3	4	5	6	7	8	9	10	11	12	14	16	18	20	22	24	28	32	36
				Non-Cush.	1	2	3	4	5	6	7	8	9	10	11	12	14	16	18	20	22	24	28	32	36
	2½	⅝"	7/16-20	Cushioned			3	4	5	6	7	8	9	10	11	12	14	16	18	20	22	24	28	32	36
				Non-Cush.	1	2	3	4	5	6	7	8	9	10	11	12	14	16	18	20	22	24	28	32	36
	3¼	1"	¾-16	Cushioned			3	4	5	6	7	8	9	10	11	12	14	16	18	20	22	24	28	32	36
				Non-Cush.	1	2	3	4	5	6	7	8	9	10	11	12	14	16	18	20	22	24	28	32	36
	4	1"	¾-16	Cushioned			3	4	5	6	7	8	9	10	11	12	14	16	18	20	22	24	28	32	36
				Non-Cush.	1	2	3	4	5	6	7	8	9	10	11	12	14	16	18	20	22	24	28	32	36
	5	1"	¾-16	Cushioned			3	4	5	6	7	8	9	10	11	12	14	16	18	20	22	24	28	32	36
				Non-Cush.	1	2	3	4	5	6	7	8	9	10	11	12	14	16	18	20	22	24	28	32	36
	6	1⅜"	1-14	Cushioned			3	4	5	6	7	8	9	10	11	12	14	16	18	20	22	24	28	32	36
				Non-Cush.	1	2	3	4	5	6	7	8	9	10	11	12	14	16	18	20	22	24	28	32	36
	8	1⅜"	1-14	Cushioned			3	4	5	6	7	8	9	10	11	12	14	16	18	20	22	24	28	32	36
				Non-Cush.	1	2	3	4	5	6	7	8	9	10	11	12	14	16	18	20	22	24	28	32	36
HYDRAULIC	1½	⅝"	7/16-20	Cushioned			3	4	5	6	7	8	9	10	11	12									
				Non-Cush.	1	2	3	4	5	6	7	8	9	10	11	12									
	2	1"	¾-16	Cushioned			3	4	5	6	7	8	9	10	11	12	14	16	18	20	22	24	28	32	36
				Non-Cush.	1	2	3	4	5	6	7	8	9	10	11	12	14	16	18	20	22	24	28	32	36
	2½	1"	¾-16	Cushioned			3	4	5	6	7	8	9	10	11	12	14	16	18	20	22	24	28	32	36
				Non-Cush.	1	2	3	4	5	6	7	8	9	10	11	12	14	16	18	20	22	24	28	32	36
	3¼	1⅜"	1-14	Cushioned			3	4	5	6	7	8	9	10	11	12	14	16	18	20	22	24	28	32	36
				Non-Cush.	1	2	3	4	5	6	7	8	9	10	11	12	14	16	18	20	22	24	28	32	36
	4	1¾"	1¼-12	Cushioned			3	4	5	6	7	8	9	10	11	12	14	16	18	20	22	24	28	32	36
				Non-Cush.	1	2	3	4	5	6	7	8	9	10	11	12	14	16	18	20	22	24	28	32	36
	5	2"	1½-12	Cushioned			3	4	5	6	7	8	9	10	11	12	14	16	18	20	22	24	28	32	36
				Non-Cush.	1	2	3	4	5	6	7	8	9	10	11	12	14	16	18	20	22	24	28	32	36

① "A" and "H" Models 82, 84 and 86 with strokes over 18" require stop tubes.

Column strength requires larger diameter piston rods for the following:

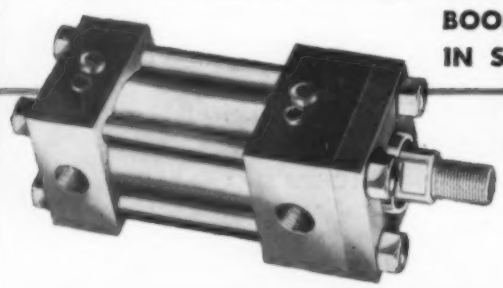
Air Cylinder Models A82, 84, and 86 with strokes inside area (1), when operated at 100 psi and over;

All hydraulic models with strokes inside area (2) and Models H82, 84, and 86 with strokes in area (4), when operated at 2000 psi and over;

Models H82, 84 and 86 with strokes inside area (3), when operated at 1000 psi and over.

Depending upon Trunnion Pin location, "A" and "H" Models 83 with standard diameter piston rods can have longer strokes than Models 82, 84 and 86.

See Miller File #251 for oversize piston rod and stop tube requirements.



BOOSTERS IN STOCK

Immediate Delivery on the following Miller 25 to 1 Ratio Boosters (80 psi air input produces 2000 psi hydraulic oil output): Model B4, 5" bore, 1" dia. ram, 6" and 12" strokes; Reciprocating Booster Model DA77-RBA8, 5" bore, 1" dia. ram, 6" stroke. Also Booster Tanks, 5" dia., 6" and 10" heights.

Write For Catalog and Stock Price List

MILLER FLUID POWER DIVISION
FLICK-REEDY CORP.

Miller

2008 N. HAWTHORNE AVE., MELROSE PARK, ILL.

AIR & HYDRAULIC CYLINDERS • BOOSTERS • ACCUMULATORS
COUNTERBALANCE CYLINDERS

BRIEFS continued

12th National Conference On Industrial Hydraulics

This year's annual meeting—October 18-19, Sherman Hotel, Chicago—will feature the use of hydraulics in the nuclear energy field at the opening general session, under the chairmanship of Joseph C. Boyce, vice president, Illinois Institute of Technology.

The following have been named principal officers for the 1956 sessions: *R. O. Isenberger*, chief engineer, Chicago Rawhide Mfg. Co.—director; *Robert Q. Sharpe*, staff engineer, Socony Mobil Oil Co.—chairman, hydraulic fluids; *M. G. Sulser*, regional sales manager, Dension Engineering Co.—chairman, presses; *F. L. Mackin*, chairman, Machine and Woodshops and Hydraulics, General Motors Institute—chairman, automotive equipment; *John A. Lauck*, vice president, Pesco Products Div., Borg-Warner Corp.—chairman, pumps; *James O. Heyworth*, vice president, Barco Mfg. Co.—chairman, components and accessories; *Joseph J. Slomer*, hydraulic engineer, Goodman Mfg. Co.—chairman, pneumatics; *Joseph F. Ziskal*, assistant division chief engineer, Advanced Engineering Dept., International Harvester Co.—chairman, mobile equipment; *Ernest J. Svenson*, president, John S. Barnes Corp.—chairman, machine tools; *John T. Marshall*, chief engineer, Hamilton Division Bendix Aviation Corp.—chairman, aircraft systems; and *Ralph J. King*, staff engineer, Research Department, Caterpillar Co.—chairman, systems and analysis. Twenty technical papers are being prepared for the two day conference. Advance registration can be obtained by writing: Conference Secretary, Raymond D. Meade, Illinois Institute of Technology.

J. A. Lauck
Pesco Products Div.

J. T. Marshall
Hamilton Division

J. O. Heyworth
Barco Mfg. Co.

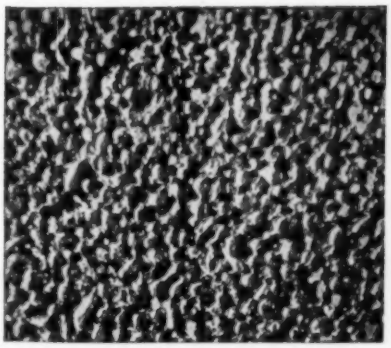
J. F. Ziskal
International Harvester Co.

F. L. Mackin
General Motors Institute

J. J. Slomer
Goodman Mfg. Co.

The Conference is sponsored by Illinois Institute of Technology with cooperation of the hydraulic industries and engineering societies. It found its beginning in 1945 when Armour Research Foundation and the Graduate School of the Institute recognized

Continued on page 32



Need a stainless steel filter with micronic pores?

You're looking at a 15-diameter magnification of PORO-KLEAN, CUNO's new sintered porous stainless steel.

It's already in use for filtering, separating, diffusing and metering fluids; for aircraft structural parts in boundary layer control and transpiration cooling, and for flame-proofing and sound deadening. Here's what PORO-KLEAN offers the designer:

1. 3- to 30-micron particle size retention as a filter.
2. Structural strength — PORO-KLEAN filter elements now in operation take a 1500 psi pressure drop.
3. Heat resistance — operating temperatures to 900°F.
4. Corrosion resistance — standard in 316 stainless steel. Low carbon content (0.03-0.05% max.).
5. No contamination of fluid—it's all metal, lint-free. No discharge of any part of filter into fluid.
6. Easily cleaned — with acids, alkalis, solvents or "back washing."
7. Standard designs—housings and elements for aircraft or industrial use.

Have you an application for this new PORO-KLEAN porous stainless steel? Discuss your problem with Cuno engineers or write for complete data. Cuno Engineering Corporation, 2-8 South Vine St., Meriden, Conn.

Poro-Klean housing and element for 12 gpm hydraulic fluid, OS-45-1, at 3000 psi operating pressure and temperatures from −65°F to 350°F. 52A

CUNO ENGINEERED FILTRATION

AUTO-KLEAN (edge-type) • MICRO-KLEAN (fibre cartridge)
FLO-KLEAN (wire-wound) • PORO-KLEAN (porous metal)

Circle 29 on Reader Service Card

MODERN HYDRAULICS
demand
MODERN ANCILLARIES

Greer-Mercier Accumulators, offering power intensification, pressure storage, shock absorption, volume compensation, and surge elimination, are available in a variety of sizes to suit any modern hydraulic application.

FOR THE MORE ECONOMICAL and BETTER OPERATION of ALL HYDRAULIC SYSTEMS

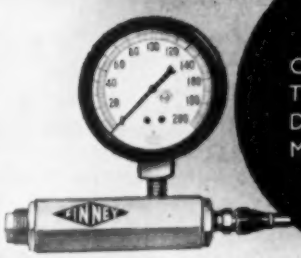
GREER-MERCIER HYDRO-PNEUMATIC ACCUMULATORS (Brit. Pats. 529112, 572725, 595165, 611934.)

Finney Sensitive Pressure Switches provide a pressure range of 400—4,000 P.S.I. with pressure differential adjustable between 100—500 P.S.I. For wide differentials two micro-switches are fitted.

COMPACT, ADJUSTABLE, SENSITIVE PRESSURE SWITCHES

For OIL, WATER and OTHER LIQUIDS.

This Cut-Out Valve automatically isolates recording instruments from pressure surges and offers complete protection within its pressure range of 50 to 4,000 P.S.I.



COMPLETE PROTECTION for the MOST DELICATE INSTRUMENT.

GAUGE CUT-OUT VALVE

FAWCETT FINNEY LIMITED

FAWCETT-FINNEY LIMITED

BERKLEY STREET BIRMINGHAM 1

Telephone: MIDLAND 3795 (3 lines) Cables: FINHYD BIRMINGHAM

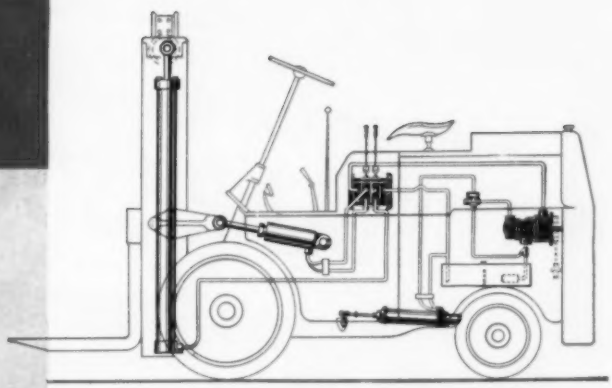
A METAL INDUSTRIES GROUP COMPANY

VICKERS

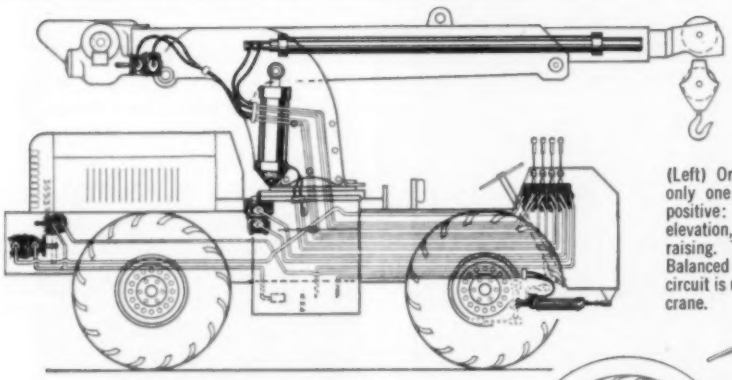
HYDRAULIC SYSTEMS

Designate Superior Materials Handling Equipment

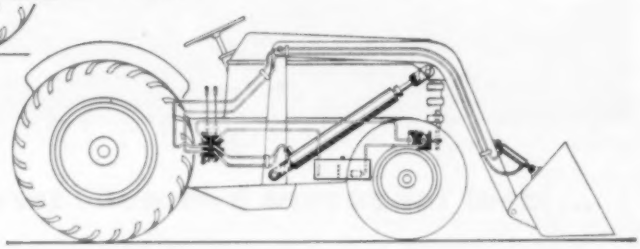
"Nobody sets a diamond in a brass ring." And when a manufacturer of materials handling equipment uses Vickers Hydraulics, it is indicative of superior quality throughout. To the inherent advantages of hydraulic control, Vickers adds the benefits of a nation-wide and full time field engineering and service organization of unequaled experience. Vickers has the complete line of hydraulic equipment necessary to take undivided system responsibility . . . to eliminate any risk of incompatibility of hydraulic components. For further information, ask for new Bulletin M5101A.



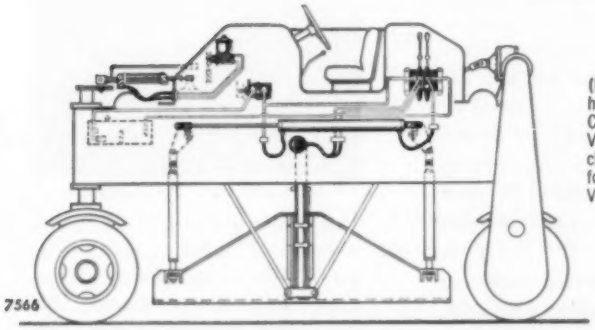
(Above) Fast tilting and lifting are possible along with exclusive "feathering" ability. Also, fingertip power steering permits operator to maneuver vehicle with one hand and control loading operations with the other. Additional vehicle attachments can be hydraulically controlled by simply adding sections to existing control valve eliminating necessity of mounting separate valves.



(Left) One Vickers Hydraulic System (using only one pump) provides fast, smooth and positive: (1) turntable rotation, (2) boom elevation, (3) boom extension, and (4) load raising. Turntable is driven by a Vickers Balanced Vane Type Fluid Motor. Another circuit is used for power steering this hydraulic crane.



(Right) Fast, easy and dependable operation of front end loader depends upon Vickers Balanced Vane Pump and Vickers Two-Section Directional Control Valve. Automatic wear compensation is inherent in all Vickers Balanced Vane Type Pumps. Note simplicity of installation.



7566

(Left) Straddle carrier uses hydraulic power to handle the load with precision and speed. Compact, two-section Vickers Multiple Unit Valve has double-acting valve for opening and closing load hooks and single-acting section for raising load. Separate circuit provides Vickers Hydraulic Power Steering.

WRITE FOR BULLETIN M5101A

VICKERS INCORPORATED

DIVISION OF SPERRY RAND CORPORATION

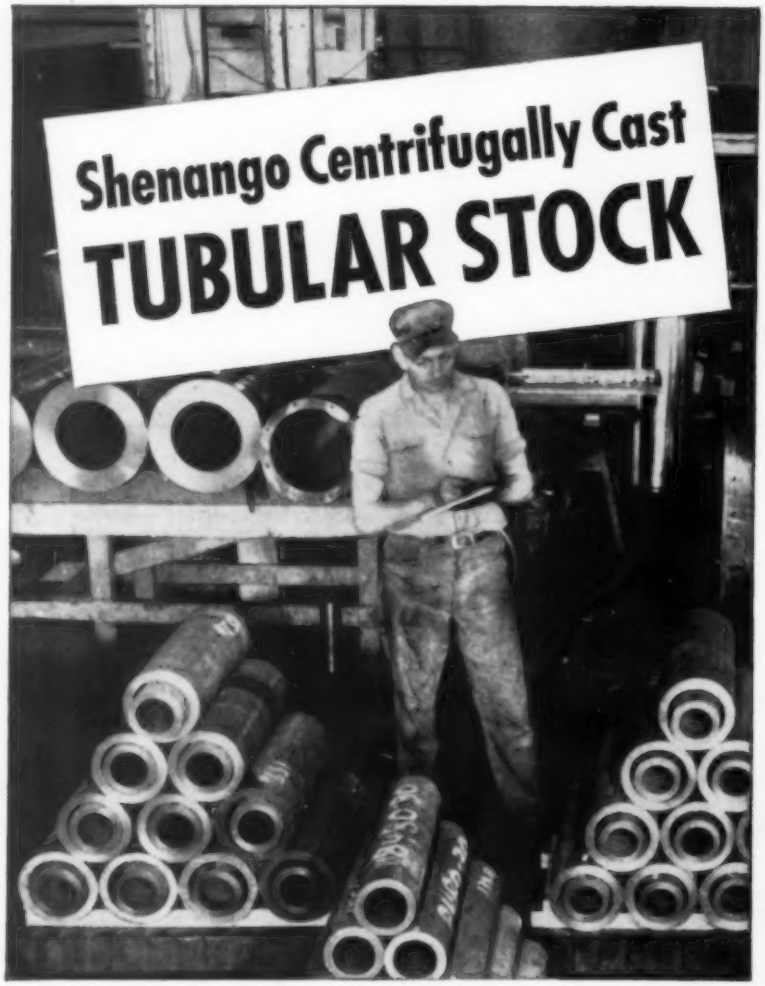
ADMINISTRATIVE and ENGINEERING CENTER

Department 1474 • Detroit 32, Michigan

Application Engineering Offices: • ATLANTA • CHICAGO CINCINNATI • CLEVELAND • DETROIT • HOUSTON • LOS ANGELES AREA (El Segundo) • MINNEAPOLIS • NEW YORK AREA (Summit, N.J.) • PHILADELPHIA AREA (Media) • PITTSBURGH AREA (Mt. Lebanon) • PORTLAND, ORE. • ROCHESTER • ROCKFORD • SAN FRANCISCO AREA (Berkeley) • SEATTLE • ST. LOUIS • TULSA WASHINGTON • WORCESTER

IN CANADA: Vickers-Sperry of Canada, Ltd., Toronto

ENGINEERS AND BUILDERS OF OIL HYDRAULIC EQUIPMENT SINCE 1921



...ideal for severe hydraulic service!

In standard tubular stock, as in special cylinders and other made-to-order components, the Shenango centrifugal casting process makes a world of difference. Centrifugal action forces impurities out of the molten metal, prevents inclusions and porosity, and assures a more uniform, *pressure-dense* grain! Thus the metal is stronger, more wear resistant, and machines to a superior finish.

Shenango tubular stock in both bronze and high strength Meehanite Metal is made in a complete range of I.D. and O.D. sizes and in lengths up to 20 feet, depending on diameter, to minimize cut-off waste.

For detailed bulletins or sales-engineering service write to Shenango-Penn Mold Company, Centrifugal Castings Division, Dover, Ohio.

SHENANGO CENTRIFUGAL CASTINGS

COPPER, TIN, LEAD, ZINC BRONZES • ALUMINUM AND MANGANESE BRONZES
MONEL METAL • NI-RESIST • MEEHANITE METAL • ALLOY IRONS

BRIEFS / continued

the need for close cooperation between the different engineering fields in solving industrial problems. The technical meeting of the first conference was called "Conference on Hydraulic Machinery", and the success of this conference led to its establishment as an annual meeting. In order to better describe the technical content of these meetings, the name "National Conference on Industrial Hydraulics" was selected. ▼▼▼

Pneumatic Cylinders Replace Manual Operation

Punching out long rolls of perforated steel is one of the principal operations of Standard Stamping and Perforating Co., in Chicago. Stock feeding is accomplished by

Figure 1

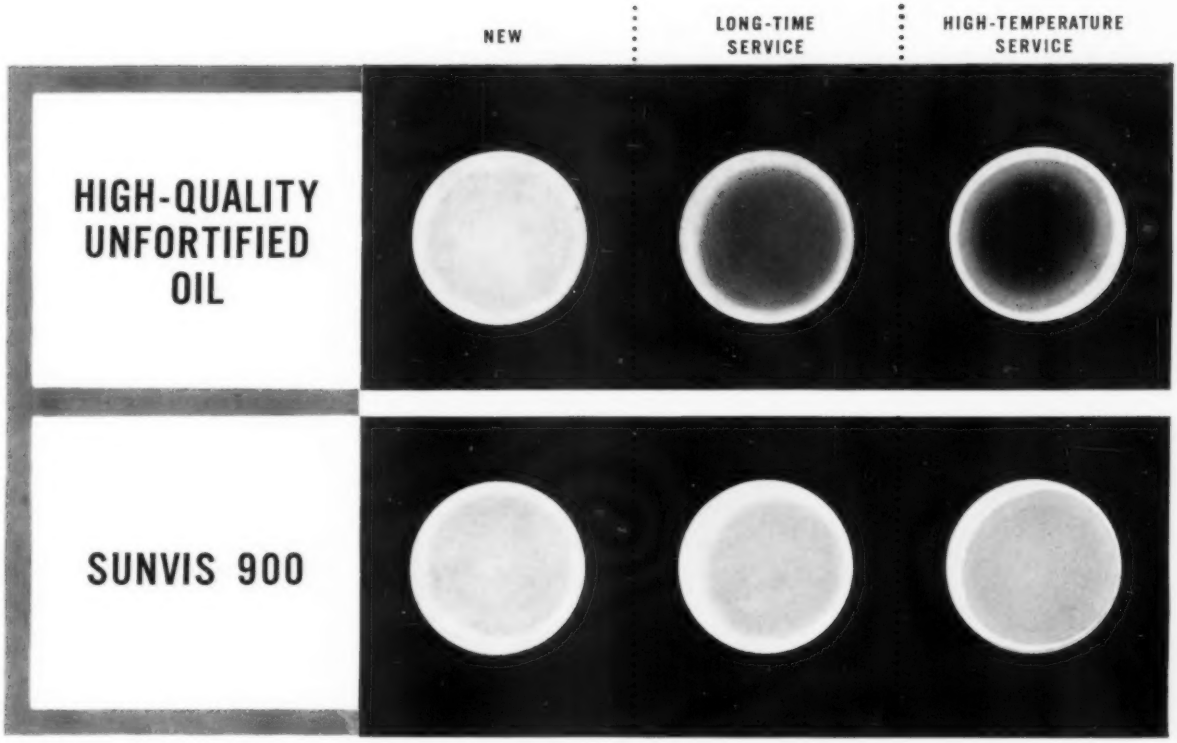
Figure 2

Figure 3

feed rolls which were formerly opened and closed manually (Figure 1) through a series of mechanical levers and springs. This was a job dreaded by shop personnel until chief engineer Bob Rosencranz designed an air-powered system to do the job.

In the first conversion (Figure 2), an all-pneumatic system was installed with a 4-way valve conveniently mounted to control the

Continued on page 35



Oil color tests show

WHY SUNVIS 900 OILS SAVE YOU MONEY IN CIRCULATING AND HYDRAULIC SYSTEMS

Color means very little in brand new oils. But...color *change* during service can mean a lot. While minor darkening is seldom serious, radical color changes indicate danger, except, perhaps, in a highly detergent oil.

Either the oil is contaminated by foreign matter, or as in the pictures, the oil has oxidized from heat and long use. The products of oxidation darken the color of ordinary oils...clog valves and filters, cause excessive maintenance.

Compare the appearance of the used Sunvis 900 with the appearance of the other used oil. The color of used Sunvis 900 is practically the same as new Sunvis 900. There is not a sign of oxidation products.

Here's proof that Sunvis 900 oils will last longer and provide the extra needed resistance against the high temperature "hot-spots" of typical hydraulic and circulating systems. *For the long run, a Sunvis 900 oil is the most economical oil you can buy.*

For more information about Sunvis 900 oils, see your Sun representative, or write for Technical Bulletin 35. Address SUN OIL COMPANY, Philadelphia 3, Pa., Dept. I-31.

INDUSTRIAL PRODUCTS DEPARTMENT

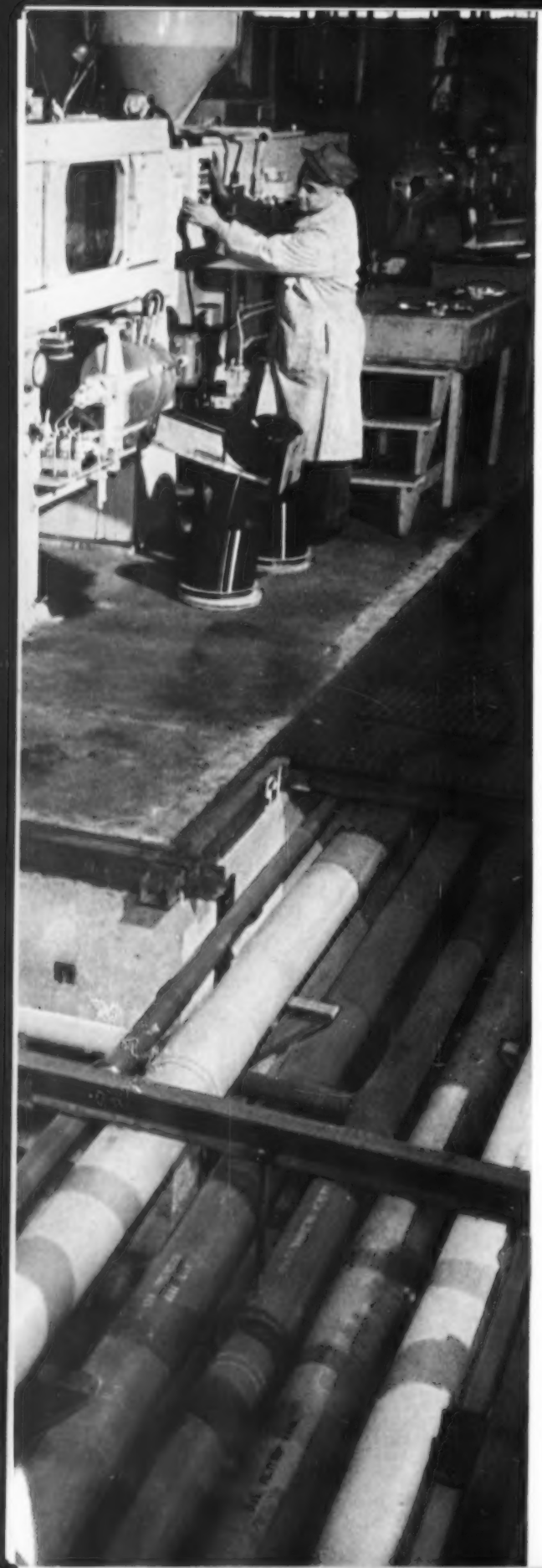
SUN OIL COMPANY

Philadelphia 3, Pa.

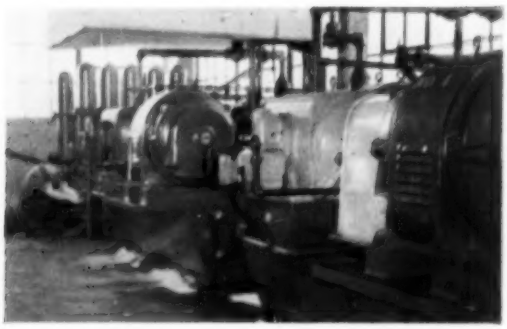
©SUN OIL CO.

In Canada: Sun Oil Company Limited, Toronto and Montreal

SUNOCO®



High-Pressure Pumps, below, each handle 54 gpm of Sunvis 931 at 2500 psi. Unique closed-loop hydraulic system, left, features color-coded piping.



NEW CENTRAL HYDRAULIC SYSTEM PROTECTED BY SUNVIS 931 OIL

The new variable-pressure hydraulic system at Columbia Records in Bridgeport, Conn., delivers oil at 2500 psi to as many as 40 injection molding machines. Round-the-clock production of micro-groove records depends on the reliability of this system.

Columbia picked Sunvis 931 because their tests and experience have shown it doesn't form carbon or leave harmful deposits...even after years of use. Because of their long life, Sunvis 900 oils are the least expensive oils you can buy for tight circulating systems.

This is just part of the story about Sunvis 900 oils. Why not talk them over with your Sun representative the next time he calls. Or write to SUN OIL COMPANY, Philadelphia 3, Pa., Dept. I-32.

SUNOCO®

INDUSTRIAL PRODUCTS DEPARTMENT

SUN OIL COMPANY

© SUN OIL CO.

Philadelphia 3, Pa.

In Canada: Sun Oil Company Limited, Toronto and Montreal

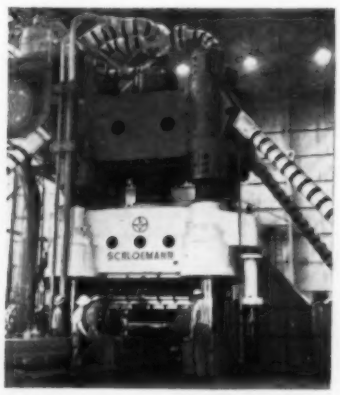
BRIEFS / continued

air cylinder. In the latest installation (Figure 3) a solenoid valve is mounted at the air cylinder and a pushbutton station replaces the 4-way valve. This makes a much neater installation with less maintenance requirements. Nobody minds turning the valve or pushing the button now. ▼▼▼

Giant Of The West Coast

Large precision aircraft forgings of the close tolerances, low draft type are important products of the West Coast's first large hydraulic forging press. The 8000 ton press, built by Schloeman A.G. of Dusseldorf, Germany, is now in operation at the Vernon (California) Works of the Aluminum Company of America.

The press incorporates a four column, three cylinder design, en-

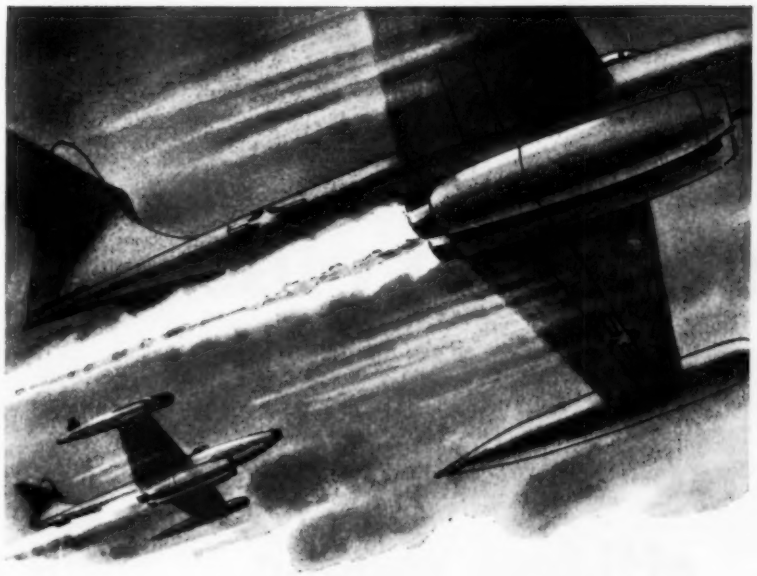


Giant press is 49 feet high, 33 feet of which are above floor level, weighs 750 tons. The four struts at corners make press earthquakeproof.

abling it to operate at 2700, 5400 or 8000 tons of force. Four 2500 gallon accumulator bottles under a pressure of 4500 psi provide the hydraulic pressure, which is maintained by three septuplex hydraulic pumps capable of pumping a total of 700 gpm. The pumps are driven by directly coupled electric motors rated at 700 hp.

Each half of the largest dies weighs as much as 7 tons. When dies are changed the die table is hydraulically withdrawn from the

Continued on page 38



hydraulic packings that "STAY PUT"

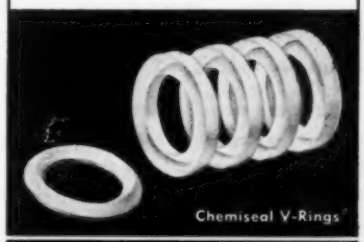
Chemiseal hydraulic packings . . . made of chemically impervious duPont TEFLON . . . have zero swelling in all hydrocarbons, new synthetic hydraulic fluids and solvents. Require no chemical inspection. Unsurpassed anti-friction properties, are tough, resilient, nonflammable, long wearing. Wide service temperature range from minus 110° F to plus 500° F.

CHEMISEAL V-Type Packings are ideal for either manual or automatically operated valves. Seal with low gland pressure and operating torque. Square end TEFLON adaptors are available if required.

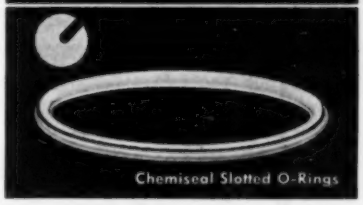
CHEMISEAL Back-up Rings prevent "O"-ring extrusion and greatly lengthen their life. Spiral, solid and split ring types are available in all commercial and AN sizes.

CHEMISEAL Slotted O-Rings (patented) provide greater cross-sectional deformability, thermal expansion compensation and automatic pressure-sealing action. Designed to fit standard AN grooves. Write for further information.

made of du Pont TEFLON


Chemiseal V-Rings

Chemiseal Back-up Rings

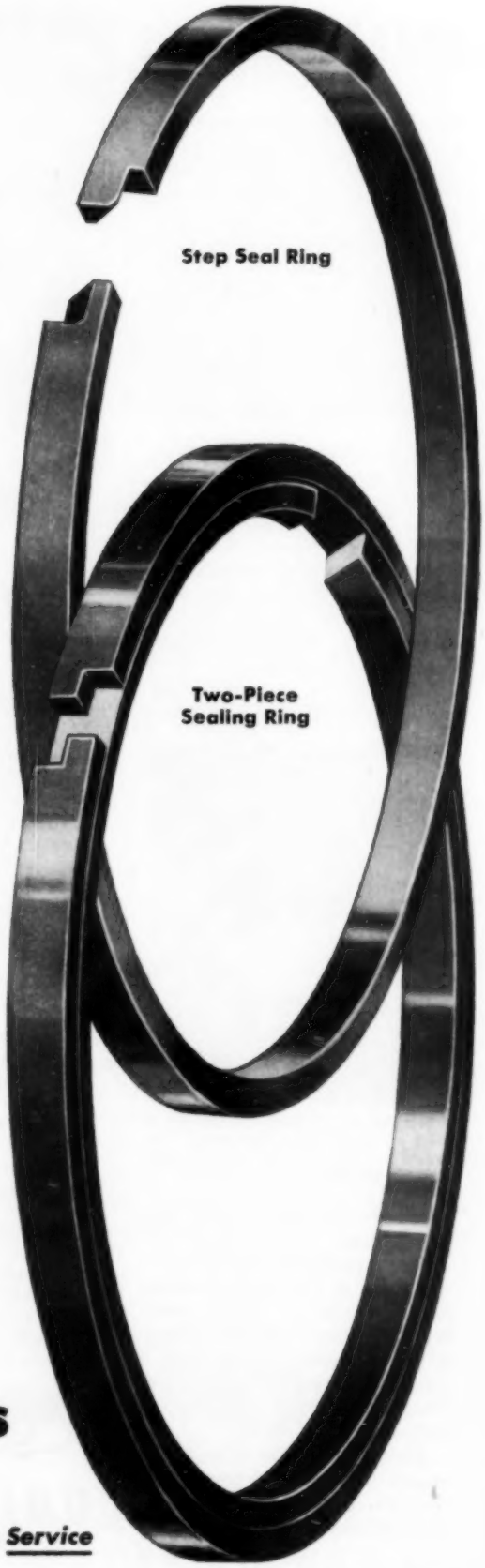

Chemiseal Slotted O-Rings

UGB BELMONT

UNITED STATES GASKET CO.

CAMDEN 1, NEW JERSEY

KOPPERS SEALING RINGS REDESIGNED to give the most efficient sealing available!



Reduce Leakage to a Minimum!

Fewer Rings Required!

Redesigned Koppers Sealing Rings provide *tighter*, better sealing for your hydraulic, pneumatic and other applications . . . under a variety of operating conditions. And, you need *fewer* rings because Koppers Sealing Rings are redesigned to give the *tightest* seal.

Koppers *redesigned* Sealing Rings can be used for static sealing, for sealing rotating and reciprocating motion . . . under high temperatures, corrosive conditions, poor lubrication and where high-strength materials are required. Koppers Sealing Rings are available in grey iron, in high-strength ferrous and non-ferrous alloys.

A wide range of standard Koppers Sealing Rings is immediately available. However, if you have a new application, our engineers will *custom-design* a ring to fit your individual needs. They'll produce a ring that gives you top performance under your particular operating conditions. For more detailed information, write to: KOPPERS COMPANY, INC., Piston Ring and Seal Dept., 1508 Scott Street, Baltimore 3, Maryland.

KOPPERS

SEALING RINGS

Koppers Company, Inc.,
Metal Products Division
Piston Ring And Seal Dept.

Engineered* Products Sold With *Service

Circle 57 on Reader Service Card

for HAZARDOUS LOCATIONS

SKINNER EXPLOSION-PROOF Solenoid Valve
Only 3 21/32" high

Skinner X5 Series Explosion-Proof stainless steel Valves are ideal for use in hazardous applications. They are Underwriter Approved for Class I (Gasoline vapors, etc.), and Class II, Groups F (Grain dust) and G (Coal and coke dust), and offer you incomparable simplicity and flexibility of design.

These low-cost valves are expertly engineered to give trouble-free performance through millions of cycles. They're direct-acting, leakproof and spring loaded for operation in any position. Available in a wide range of types, voltages, pressures, flow control adjustments, port sizes and port locations.

SPECIFICATIONS: Type: Two- and Three-Way Normally Open, Normally Closed, and Directional Control; Pressure Range: 0-1000 p.s.i. Orifice Diameters: 1/64" to 1/4". Pipe size: 1/8" or 1/4" NPT; Voltage All AC and DC; Duty Cycles: Continuous or Intermittent. *Write today for Bulletin 526A*

SKINNER

SKINNER ELECTRIC VALVE DIVISION • SKINNER CHUCK COMPANY

THE CREST OF QUALITY

SKINNER ELECTRIC VALVES®

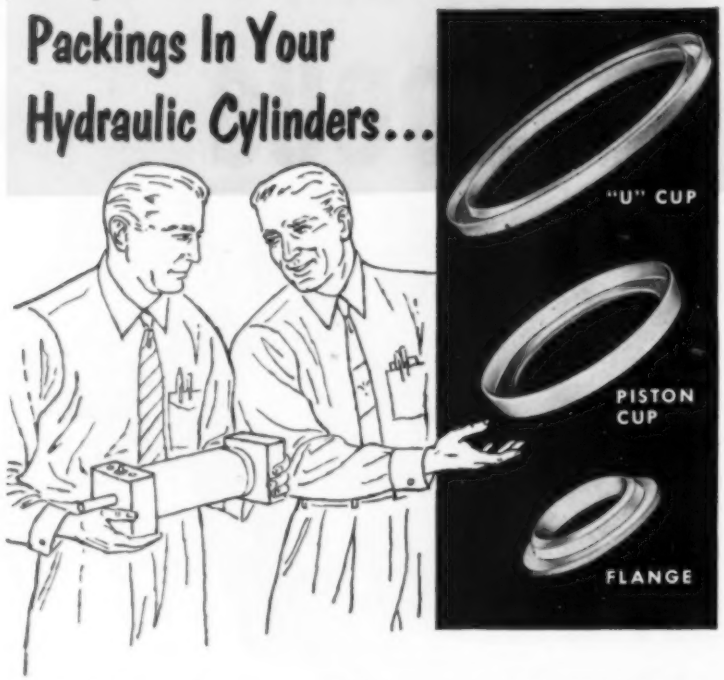
SOLENOID VALVES

105 Edgewood Avenue
New Britain, Conn.

WORLD-WIDE REPRESENTATION

Circle 89 on Reader Service Card

Why Offer Less Than CHEMLON* Packings In Your Hydraulic Cylinders...



Hydraulic equipment manufacturers are now taking a *second* look at the many advantages of "John Crane" CHEMLON hydraulic packings and offering them in place of leather, fabric-reinforced and similar packings.

THE REASON . . . CHEMLON provides several very important service advantages.

1. Increased cylinder life due to the inherent non-frictional qualities of CHEMLON.
2. Longer packing service life—CHEMLON outlasts all other types of packing to a remarkable degree . . . decidedly cuts replacement, down time and maintenance.
3. Universal application—CHEMLON'S inertness to all types of hydraulic fluids, including non-flammables and synthetics . . . eliminates the need for customers stocking a wide range of special packings.
4. Trouble-free performance—CHEMLON withstands temperature conditions encountered in hydraulic service up to 350°F.

"John Crane" CHEMLON—*The Best in Teflon*—offers a complete line of piston cup, "U" cup and flange packing for every service requirement.

Get the new bulletin No. P-322 on "John Crane" Hydraulic Packings.

Crane Packing Co., 6405 Oakton St., Morton Grove, Ill. (Chicago Suburb). *In Canada: Crane Packing Co., Ltd., Hamilton, Ont.*

*"John Crane" fabricated from DuPont Teflon

John Crane

MECHANICAL PACKINGS | SHAFT SEALS | TEFLON PRODUCTS | LAPPING MACHINES | THREAD COMPOUNDS

CRANE PACKING COMPANY

BRIEFS continued

side of the press. This giant unit has an electronically controlled stroke of 71 inches. Pressing speed is 3 inches per minute; when not under load the dies close at the rate of one foot per second. Stock for the press is extruded right at the Vernon Works. The press can be fed by an air-driven monorail system, by a mechanical manipulator or by hand.

A unique feature of the press construction is that it is earthquake proof. Mechanically attached to each corner of the top platen of the press is a 14 inch tubular strut. These are firmly secured to reinforced concrete footings. ▼▼▼

Future Events

September 17-21: The Instrument Society of America, the 11th Annual Instrument-Automation Conference and Exhibit, New York Coliseum, New York.

October 2-6: SAE Aeronautic Meeting, Aircraft Production Forum and Aircraft Engineering Display. Hotel Statler, Los Angeles, California.

October 8-12: 38th Annual Metal Congress and Exposition, Public Hall and Auditorium, Cleveland, Ohio.

October 8-12: SAE Aircraft Committees A-3, A-6 and A-6C. Hotel Biltmore, Los Angeles, California.

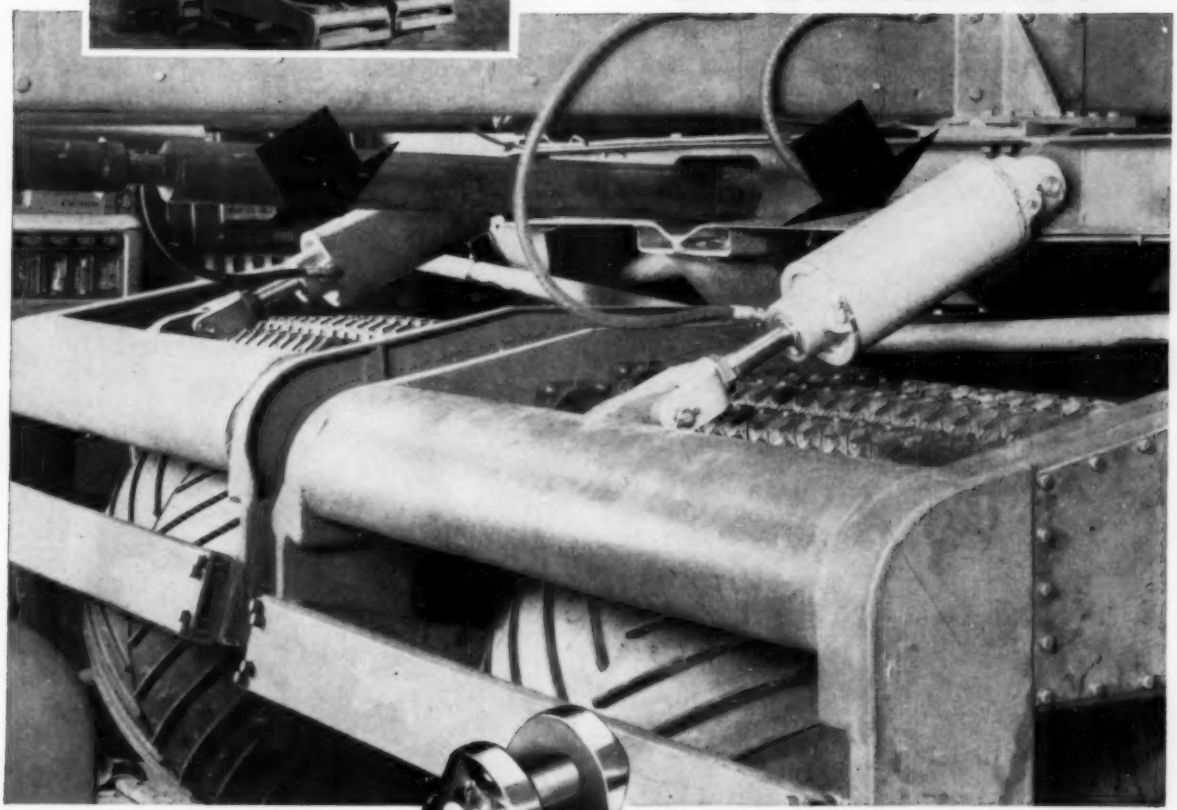
October 18-19: 12th National Conference on Industrial Hydraulics. Sherman Hotel, Chicago, Illinois. To register for the NCIH, write Illinois Institute of Technology, Chicago, Ill. Conference Secretary Raymond D. Meade.

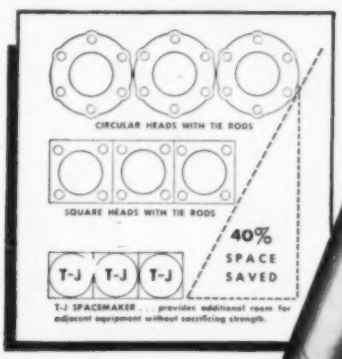
October 30-November 1: 1956 Fall Meeting, National Fluid Power Association, Hotel Cleveland, Cleveland, Ohio.

November 8-9: SAE Fuels and Lubricants Meeting. The Mayo, Tulsa, Oklahoma.

November 26-30: Third International Automation Exposition. New York Trade Show Building, New York City. ▼▼▼

Arctic Cargo Carrier Depends On T-J Spacemaker CYLINDERS




CIRCULAR HEADS WITH TIE RODS
SQUARE HEADS WITH TIE RODS
40% SPACE SAVED
T-J
T-J
T-J
T-J SPACEMAKER . . . provides additional room for adjacent equipment without sacrificing strength.

Saves 40% Space!
No Tie Rods For Greater Strength

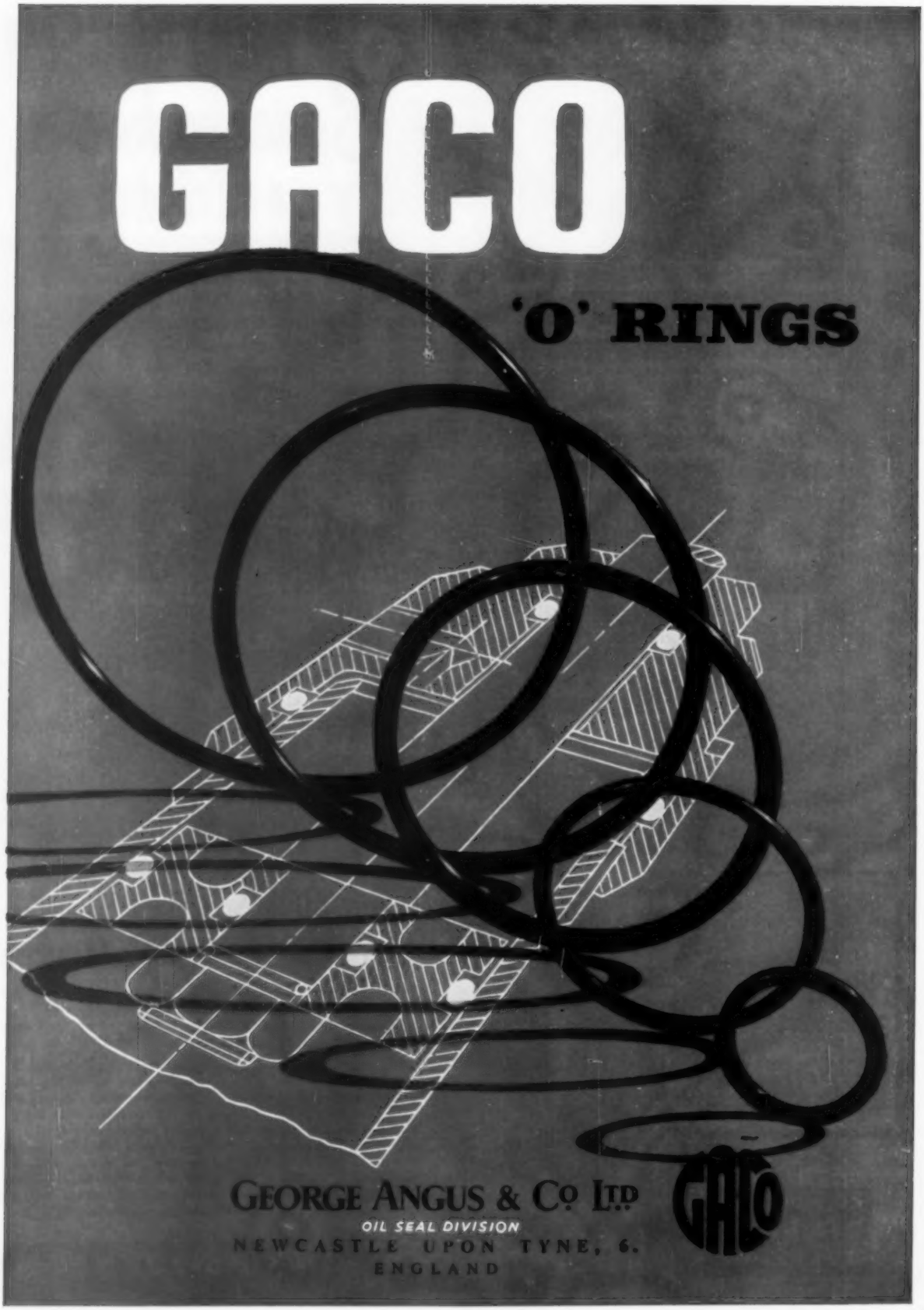
Differential axle loading through T-J Spacemaker Air Cylinders forms a controlled walking beam in this Teracruiser, designed and produced for the Army Ordnance Corps by the Four Wheel Drive Co., Clintonville, Wis.

Weight of cylinders was important factor in choosing T-J Spacemakers, which reduce weight while providing same displacement and extra high safety factor. Fast delivery and space-saving features also favored T-J. Exclusive with T-J are new Super Cushion Flexible Seals for Air (to 200 P.S.I.) . . . and New Self-Aligning Master Cushion for Oil (to 750 P.S.I.). Hard chrome plated bodies and piston rods are standard, at no extra cost. Wide range of styles, capacities . . . 64,000 combinations *off the shelf!* Write for bulletin SM-155-3. The Tomkins-Johnson Co., Jackson, Mich.

ALL MODELS . . . OFF SHELF DELIVERY

MEETS WITH ALL JIC RECOMMENDATIONS

T-J TOMKINS-JOHNSON
RIVITORS AIR AND HYDRAULIC CYLINDERS CUTTERS CLINCHORS


GACO
'O' RINGS
GEORGE ANGUS & Co LTD
OIL SEAL DIVISION
NEWCASTLE UPON TYNE, 6.
ENGLAND
GACO

FLUID POWER Pioneers

WHEN Kurt Tech came to The Cross Company 16 years ago, his goal was to become a designer. He made it. He's now vice president of engineering.

Kurt is a native Detroiter. In fact, he was born near the site of the Cross plant 34 years ago. Four years later, the growing family moved further out. After finishing high school, Kurt joined Cross as a drill press operator. He quickly became absorbed in the basic philosphy of the Cross Company—attention to details—and made it his own. In less than a year, he was in the engineering department as a combination file clerk and draftsman. In another three years he had won a place in the department as a designer. When he joined the engineering department, seven men were the entire staff. He now supervises an engineering staff of one hundred men.

Kurt's technical education was won the hard way. He attended night classes at the Lawrence Institute of Technology for eight years and was graduated in 1948 with a B.S. in M.E.

KURT TECH

The Cross Company

Detroit

The Cross Company is one of the pioneer users of hydraulics. Over 25 years ago, hydraulic circuits were used for clamping and for tool feeding.

Today, Cross is one of the major producers of transfer type equipment. Kurt, in a talk before the National Conference on Industrial Hydraulics, described a transfer machine designed to do 555 machining operations on a V-8 cylinder block. There are 109 separate hydraulic systems on the machine to provide the power and control for 96 feed movements. And the machine is under the control of one man!

Yet this monster of a machine is the result of evolution. It grew step by step from the earliest clamping and feeding operations on a single tool machine. More elaborate machines are on the boards and being assembled in the shop.

Remarkable? At Cross they don't think so. It has been a matter of attention to details. The point of view is that big design and building problems are essentially a number of small problems that can be solved separately and coordinated at each step. Ceaseless vigilance with detail is a key to skill in the design and building of multiple purpose machines. Kurt Tech is a symbol of this philosophy, which permeates the organization from the president to the newest employee.

• Fluid Power Pioneers . . . are selected by the editors of APPLIED HYDRAULICS to acknowledge the outstanding contributions they have made in the use of fluid power to improve their company's products.

Useful Literature

For your free copy of publications reviewed, fill in the reader service card

SOLENOID VALVES . . . Automatic Switch Co. has released 32-page condensed Catalog 201 to cover their line of solenoid valves. The latest designs in 2, 3, and 4-way valves are included in the catalog which also contains engineering information, flow charts, operation and construction details, illustrations, prices, and other pertinent information. Tables are included in the catalog to indicate port discharge capacities for air and oil, and nomographs show flows for water, air, and steam.

Circle 120 on Reader Service Card

OIL SEALS . . . for rotating shaft sealing form the subject of a comprehensive booklet presented by Johns-Manville. The seals consist of a tough, dense, asbestos-compound heel and a soft, flexible lip concentrically molded into one unit. Several designs including an all-purpose type, reinforced heel type, offset-movement type, and a springless type for small shaft diameters are fully described and illustrated. Also split seals and seals for special applications are presented. A table lists numerous fluids and the corresponding seal compound which is recommended. Many applications are pictured and described showing typical installations of the seals.

Circle 121 on Reader Service Card

TUBE FITTINGS . . . The Weatherhead Co. has issued Condensed Catalog C-101 to describe brass tube fittings, drain and shut-off cocks, SAE 37-degree flare fittings, Ermeto fittings, hose assemblies, and hose. Each item is illustrated with brief specification and application data. The brass tube fittings are divided into SAE 45-degree flare, compression, inverted flare, pipe, threaded sleeve, and brass drain cocks. Cutaway drawings are shown for each type of fittings. Bulk hose for pressures to 5000 psi in sizes from 3/16 to 2-inch ID is classified. A section is devoted to swaged hose assemblies with a drawing to indicate construction.

Circle 122 on Reader Service Card

FLEXIBLE COUPLINGS . . . are included in the brochure, Power Transmission Equipment, published by Lovejoy Flexible Coupling Co. One of the couplings is the spider type with one-piece cushion for service to 40 hp at 1750 rpm. Replacement of the spider requires longitudinal movement of either one of the coupling bodies or of one of the connected shafts. Another type of coupling permits radial removal of the cushions. Also included in the brochure are adjustable motor bases, variable speed transmissions, universal joints, and variable speed pulleys and belts.

Circle 123 on Reader Service Card

GEAR PUMPS . . . Keelavite Rotary Pumps & Motors Ltd. has released a specification sheet covering their gear pumps for displacements of 4, 5, 7, and 9 gal. per 1000 rev. The sheet gives dimensional data and explains nomenclature applied to the pumps. Both single and double-shaft models are available for clockwise and counterclockwise rotation. Information regarding connections and mounting is also included. The pumps are rated for 3000 rpm with pressures of 2000 psi for the 4 and 5 gpm pumps, 1700 psi for the 7 gpm pump, and 1000 psi for the 9 gpm pump.

Circle 124 on Reader Service Card

ELECTRIC MOTORS . . . The Louis Allis Co. has released a consolidated catalog designated No. 106A covering their line of a-c and d-c motors, motor control, gear motors, adjustable speed drives, and frequency converters. In addition to complete dimensional data, price, and additional specifications for each type of motor, the catalog contains a section on engineering data. This section has curves indicating speed, torque, and current for NEMA Design B and Design C motors. Torque and horsepower formulae are given with examples for computing each. Two tables indicate locked rotor torque for squirrel cage motors and the effect of variations in voltage and frequency on torque, speed, efficiency, power factor, etc.

Circle 125 on Reader Service Card

CEMENTABLE TEFLON TAPE . . . in thicknesses as low as .005 inches is announced in Specification Sheet AD 158 released by Garlock Packing Co. The sheet indicates available sizes of tape and sheet and also gives information on adhesives. Installation instructions are given including surface pretreatment, applying adhesive, curing, and the use of adhesives. The tape is furnished with a slippery surface on one side and a specially prepared surface on the other side that can be bonded with commercial adhesives to wood, glass, metal, and other surfaces. The new cementable Teflon tape is available in continuous rolls in thicknesses from .005 to .060 inches. The sheets are available in thicknesses from 1/32 to 1 inch.

Circle 126 on Reader Service Card

For more reviews of FREE LITERATURE turn to page 104

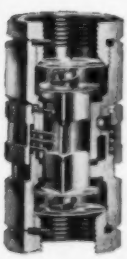
*Snap-Tite

QUICK-CONNECT
QUICK-DISCONNECT COUPLINGS

in larger sizes

immediate delivery
FROM FACTORY STOCKS

Snap-Tite's "H" Couplings are now factory-stocked for quick shipment to you, not only in the smaller sizes (below 1" ID) but in all sizes up to and including 3"—in steel, brass, aluminum, and 303 and 316 **Stainless Steel.** And "H" Couplings can be made to your order, up to 10" ID.



Available with valves to give two-way or one-way automatic line shut-off, or without valves for straight-thru flow, "H" Couplings are built to handle high pressures in hydraulic and air systems.

Recessed valve washers . . . fluted valve stems . . . valve stops with minimum flow restrictions . . . large inside diameter—allow maximum flow capacity with lowest pressure drop.

See the Snap-Tite representative in your city or write for Bulletin 240.

SNAP-TITE'S "H" COUPLING, SIZE FOR SIZE, IS THE SMALLEST COUPLING WITH HIGHEST STRENGTH AND HIGHER EFFICIENCY

*Snap-Tite, INC.

UNION CITY 1, PENNSYLVANIA

SNAP-TITE COUPLINGS CAN HANDLE ALMOST ANYTHING THAT FLOWS

New Products

Components, tools and equipment for fluid power systems. For more information fill in and mail post card bound in this issue.

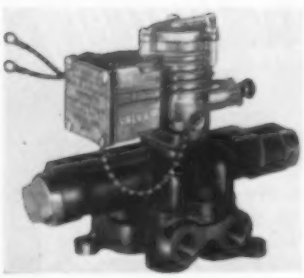
TANDEM GEAR PUMP
. . . for mobile equipment

Designation: Series 3000-2000

Features: Pump unit is for heavy-duty applications requiring two separate sources. Larger pump is rated at 1000 psi and delivers 36 to 64 gpm at speeds to 1200 rpm. Smaller pump delivers 10 to 25 gpm for auxiliary circuits such as power steering.

Design: Pump has pressure-balanced wear plate. By balancing pressure on the front and back of the wear plates, a fixed clearance is maintained between the wear plates and the gear faces regardless of pressure. Thus oil slippage is reduced to a fixed minimum, and there is no excessive power loss due to the force of the plate against the gears.

Kalamazoo Div.
The New York Air Brake Co.
Kalamazoo, Michigan
Circle 160 on Reader Service Card



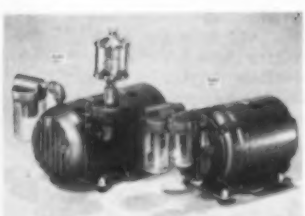
SOLENOID AIR VALVES
. . . conform to JIC

Designation: Speed King

Design: Valves have moisture and dust-proof solenoid enclosure sealed to prevent entrance of splashing liquids or airborne contaminants. Units have safety solenoid cover which renders the valve electrically inoperative when cover is removed, and integral junction box large enough to accommodate 6-in., taped pigtail leads. Junction box has threaded conduit connection, and retaining chain on junction box cover keeps cover with valve.

Specifications: Valves are available in single and double solenoid types for foot, sub-base or manifold mounting in ¼, ⅜, ½, and 1-inch pipe sizes. Optional features include manual over-ride for use during machine set-up, self-contained speed control, power-centered neutral, and an integral junction box with captive removable cover and fasteners. Pressure ranges are 35-200 psi air, and 35—125 psi oil for both single and double solenoid valves with internal pilot supply.

Valvair Corp.
Akron, Ohio
Circle 161 on Reader Service Card



AIR PUMPS
. . . with reduced weight

Designation: Models 0211, 0321, 0521

Features: New integral motor designs have average weight reductions of 1/3 over former models. Rotors are mounted directly on shaft of motor. Size is also reduced with improved appearance.

Performance: Model 0211 is 1/6 hp and weighs 22 lb. Unit delivers 1.3 cfm at 25 psi. Model 0321 delivers 2.2 cfm with ¼-hp motor at 25 psi. Model 0521 delivers 3.8 cfm with 1/3-hp motor. Both larger models have forced-air fan cooling for continuous service at moderate temperatures.

Gast Manufacturing Co.
Benton Harbor, Mich.
Circle 162 on Reader Service Card

For more NEW PRODUCT reviews turn to page 91

It's the BALANCED Synclinal DESIGN

SUMP TYPE
(Cutaway)

LINE TYPE
(Cutaway)

that makes MARVEL SYNCLINAL FILTERS AMERICAN INDUSTRY'S A-1 CHOICE

In the plants of America's industrial giants, as well as in smaller plants, Marvel Synclinal Filters are installed on all types of hydraulic and other low pressure liquid circulating equipment. Marvels are chosen because of their excellent performance in protecting machines and increasing production by reducing down time. They are proving again and again, their superiority in the one real test—ON THE JOB! The BALANCED Synclinal Design of Marvel Filters provides that all-important balance between maximum ACTIVE filtering area and sufficient storage space for filtered out particles—therefore, longer periods of productive operation are attained at the absolute minimum of maintenance. They meet J. I. C. Standards.

EASY MAINTENANCE—Both sump and line type filters may be easily disassembled, thoroughly cleaned and reassembled by any workman, on the spot, in a matter of minutes. Line type operates in any position and may be serviced without disturbing pipe connections.

Not only plant operators, but also, OVER 650 ORIGINAL EQUIPMENT MANUFACTURERS have recognized the superiority of Marvel Synclinal Filters and now install them as standard equipment.

**SPECIFY MARVEL SYNCLINAL FILTERS ON NEW EQUIPMENT--
STANDARDIZE WITH MARVELS ON EXISTING EQUIPMENT**

A SIZE FOR EVERY NEED

Available for sump or line installation in capacities from 5 to 100 G. P. M. Greater capacities may be attained by multiple installation (as described in catalog). Choice of monel mesh sizes range from coarse 30 to fine 200.

WATER FILTERS

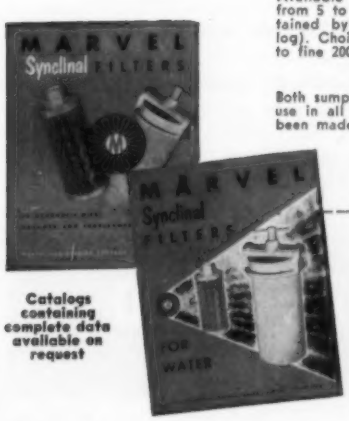
Both sump and line type filters have been adapted for use in all water filtering applications. No changes have been made in the basic, balanced synclinal design.

IMMEDIATE DELIVERY!

As in the past, Marvel continues to offer IMMEDIATE DELIVERY.

FILTERS FOR FIRE-RESISTANT HYDRAULIC FLUIDS

Marvels most recent development is a filter for the efficient filtration of all types of fire-resistant hydraulic fluids.



Catalogs containing complete data available on request

MARVEL ENGINEERING CO.
7227 N. HAMLIN AVE., CHICAGO 45, ILL.
PHONE: JUNIPER 8-6023

Without obligation, please send me complete data on Marvel Synclinal Filters as indicated.

Catalog No. 107 for Hydraulic Oils, Coolants, Lubricants — AH-8
Catalog No. 301 for Water
Data on filters for fire-resistant hydraulic fluids ☐ Aqueous ☐ Synthetic

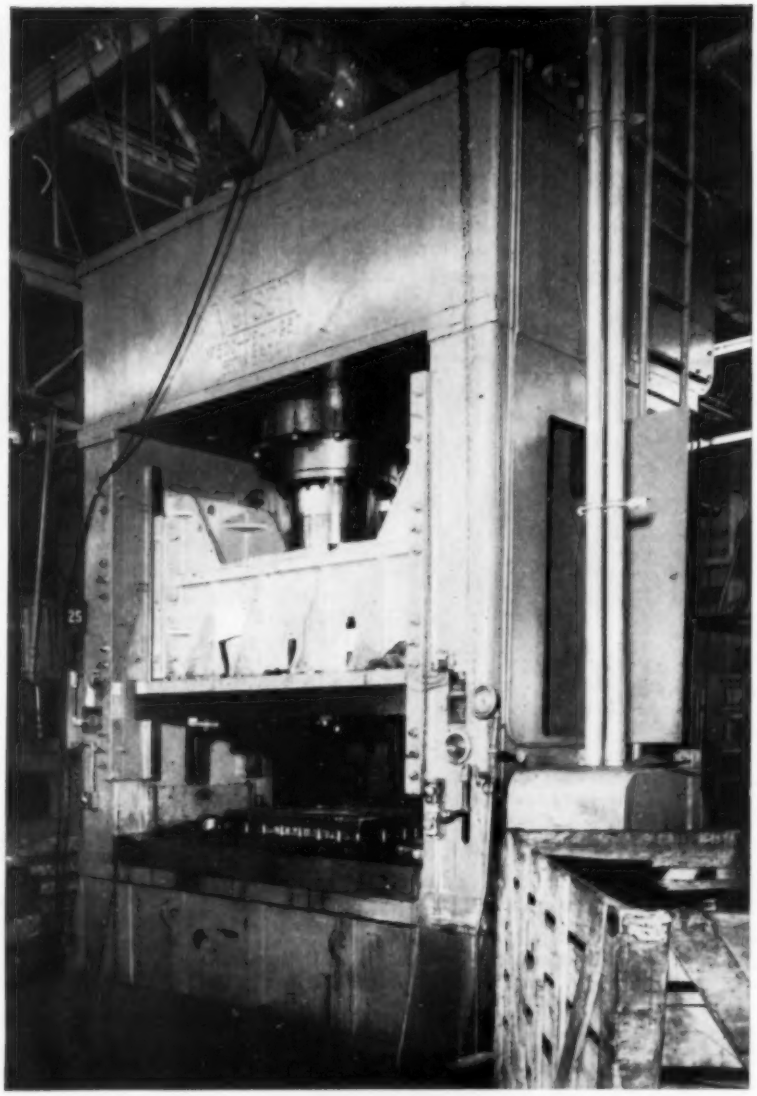
Name ..... Title .....

Company .....

Address .....

City ..... State .....

Use the medium that keeps efficiency high . . . costs low



WHEN *Texaco Regal Oil R&O* is the hydraulic medium, the entire system stays clean. *Texaco Regal Oil R&O* has exceptional oxidation resistance . . . *ten times* that of ordinary hydraulic oils. It effectively prevents the formation of rust, sludge and foam. Continued high operating efficiency is assured.

Maintenance savings, too, back up your choice of *Texaco Regal Oil R&O*. Because operation is always smooth and dependable — pumps, valves and other vital parts last much longer. Downtime and upkeep costs are considerably reduced.

There is a complete line of *Texaco Regal Oils R&O* . . . one for every hydraulic mechanism, every operating condition. A Texaco Lubrication Engineer will be glad to help you make the proper selection.

Just call the nearest of the more than 2,000 Texaco Distributing Plants in the 48 States, or write:

The Texas Company, 135 East 42nd Street, New York 17, N. Y.

TEXACO

TEXACO Regal Oils R&O

FOR ALL HYDRAULIC UNITS

Circle 98 on Reader Service Card

Drain your oil every six months . . .

Don't drain it at all . . .

Drain it when the Neutralization Number reaches .5 or maybe 1.0 . . .

Which of these opinions is right? Should it be drained at all—if so, when?

WHY and WHEN TO DRAIN HYDRAULIC OIL

• By R. Q. Sharpe

CARING for oil is like caring for yourself. When you feel well, the world is your oyster, and you keep right on going. But when you are ill, you go to bed and call a doctor. So it is with oil. When your hydraulic oil is clear and clean, it will keep your hydraulic system running smoothly with rapid response and snappy valve action, and the oil may remain in service indefinitely. But when it becomes contaminated, or deposits have formed as a result of oxidation, the hydraulic system grows sluggish, valves function erratically, and production starts to drop off. That is the time for your lubrication doctor to examine the oil to see if it must be drained or whether it can be reclaimed.

R. Q. SHARPE, *Senior Engineering Representative, Socony Mobil Oil Company, Inc., New York, N. Y.*

The real purpose of draining hydraulic oil is to remove from the system undesirable impurities or compounds that are apt to interfere with the functioning of the pumps, valves or driven mechanisms. If the oil can be kept clean, or the undesirable compounds avoided, then it should not be necessary to drain the oil at all. How, then, can we determine the presence of materials which will interfere with the oil performance? The answer to this question will tell us when to drain the oil.

OIL PROPERTIES

In order to determine when to drain the oil, it is necessary that we clearly understand oil properties and how they are affected by undesirable impurities and compounds. A successful petroleum hy-

FACTORS IN OIL ANALYSIS

SPECIFIC GRAVITY

Although the specific gravity reading of an oil is not an index of oil quality, a change from the original specific gravity may indicate that the wrong oil has been added to the system. A high quality, solvent-refined, hydraulic oil will show an API (American Petroleum Industry) specific gravity reading of 26 or higher depending on viscosity.

SEDIMENT

The extent and nature of sediment in the hydraulic oil is one of the most important single determinations that can be made. The visual observation of foreign matter in the oil is of little help in determining its probable effect on system performance. Only a chemical analysis and the opinion of an expert petroleum technician can determine this effect. Examination of sediment may reveal the reasons for its presence. Metallic particles of steel, iron, brass, or aluminum will come from wear of pump parts. Bits of rubber, canvas or leather usually show wear of packings and seals. Barium or calcium soaps may indicate the presence of automobile engine oil in the system, and other forms of soaps may result from contamination by grease, galvanized containers, soluble oils, improper oils or cutting fluids. The actual volume of such materials in the used oil is important in judging the effectiveness of the system filters.

FLASH POINT

The solvents commonly used to clean hydraulic systems usually have flash points below 300 degrees F, whereas a high quality hydraulic oil has a flash point of approximately 400 degrees F. Therefore, if the oil flash point drops in use, it may indicate that some of the cleaning solvent has contaminated the oil.

APPEARANCE

Some darkening of an oil may not be significant, but a substantial change in color usually indicates contamination. New hydraulic oil of high quality is usually light in color, with a bright sparkling appearance. A change to a dull, cloudy appearance, without any particular color change often indicates contamination with water or soluable oil. Sometimes a little "kitchen chemistry" may be practiced in the field by dropping some of the oil on a hot plate. It it spits and sputters, water is probably present. However, the most accurate determination can be made only in the laboratory where the difference between water and soluble oil contamination can be accurately established. Again it must be emphasized that changes in color and appearance are alone not an accurate criterion for changing the oil. They must be considered along with other test results.

NEUTRALIZATION NUMBER

The neutralization number is the number of milligrams of potassium hydroxide required to neutralize one gram of the oil. This is perhaps the most controversial test used in evaluating oil condition, and its significance is sometimes greatly overrated. One of the first results of the oxidation of oil is the formation of acidic materials. The neutralization number indicates the formation of acidic products, although certain additives will also increase the neutralization number without any relation to the formation of acidic products. The thing that is often misunderstood is that the actual value of the neutralization number is much less important than its rate of change. Therefore, the past readings from a given charge of oil are necessary before an accurate conclusion can be reached.

VISCOSITY

Viscosity of the oil is very important and normally has much more significance than specific gravity or flash point. For industrial oils it is usually reported as Saybolt Universal Seconds at temperatures of 100 and 210 degrees F. A drop in the viscosity usually indicates that make-up oil of a lighter viscosity has been added, or that the system has been contaminated with a solvent. This alone may not require that the oil be drained from the machine. The addition of a lighter oil of equal quality may have no detrimental effect on the performance of the system. However on the other hand it may increase pump wear and the rate of internal leakage in the pump. Both of these will reduce pump efficiency. An increae in the viscosity of the used oil may also mean that the oil has started to oxidize. One of the first results of oxidation of the oil is the formation of polymerized materials that are high in viscosity and evenually form thick sludges in the oil.

MOISTURE

Moisture contributes to oil oxidation, so its determination and prompt removal is highly desirable. Soluble oil is even more damaging, since it leads to the formation of deposits that bind valves and cause erratic operation. Moisture and soluble oil may also cause rust in the system.

draulic fluid must provide these characteristics:

1. Proper viscosity at start-up and at the operating temperature.
2. Excellent oxidation stability, or freedom from deposit formation.
3. Good protection against wear.
4. Good protection against rust formation.
5. Good demulsibility, or rapid separation from water.
6. Good resistance to foaming.

If the fluid is kept clean and operated at a reasonable temperature, these properties will be present and maintained according to the quality of the oil. However, all of these properties will be adversely affected if contaminants are allowed to enter the system. Additions of the wrong oil; the entry of water, soluble oil, or solvents; or severe oxidation will all affect the viscosity of the oil. High temperatures; or contamination by soluble oil, water, or catalytic metals such as copper, iron, or lead all increase the oxidation rate of the oil. As the oil oxidizes, sludges and varnish-forming materials will deposit in pumps, valves, and lines. These materials will also increase the tendency to foam, and reduce the ability of the oil to separate from moisture. The presence of abrasive dirt or the development of acidic materials will also greatly increase the rate of wear of pump and valves. The service records of a well-known manufacturer of hydraulic pumps have shown that 70% of the troubles result from oil in poor condition.

The simplest way to determine oil condition is by visual examination and odor. A representative sample of oil should be placed in a clean glass bottle or test tube. If it smells sweet and is clear and bright, it is probably in good condition. If it has a burnt oil or rancid smell, or is cloudy or dark in color, then trouble is brewing. If water appears in the bottom of the bottle after it has stood for awhile, more trouble is present. However it still may not be necessary to drain the oil, since the undesirable impurities may be readily removed. This can be determined by a skilled petroleum technologist.

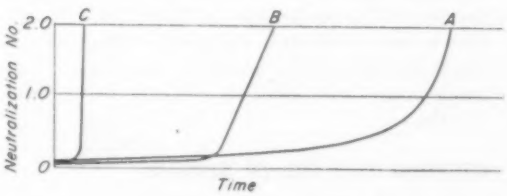
OIL ANALYSIS

Some plants tend to over-simplify the examination of the oil or to place too much reliance on the significance of only one or two observations such as color and neutralization number. This may result in discarding oil that is perfectly satisfactory for further use. The purpose of the analysis is to determine the presence of water, soluble oil, solvents, the wrong oil, metallic particles, paint flakes, as well as the degree to which the oil may be oxidized. These may be indicated by analyzing specific gravity, flash point, viscosity, color, neutralization number, moisture content and sediment.

TAKING THE SAMPLE

The accuracy of such laboratory examination is not always appreciated by the shop man who takes the sample in a dirty milk bottle, tin can, or other container that has not been thoroughly cleaned. The sample container should be a clean, metal can with a screw cap. Glass containers may be broken in transit. Because it is necessary that the sample be truly representative of the oil in the system, it should be taken from an active part of the circuit, or from the reservoir while the machine is in operation. If severe contamination from water or soluble oil is suspected, a second sample should be taken after the machine has been shut down for a while. This should be removed by a syringe from the bottom of the reservoir. Some forms of oxidized products will be soluble in the oil at the operating temperature, but may precipitate out at room temperature. Therefore, it is essential that the oil sample be taken while the machine and the oil are still warm.

The sample should be labeled with the machine designation, the brand name of the oil, the date, the length of time the oil has been in service, and the amount of make-up normally added. In addition, the reason for taking the sample and any special comment required concerning the operation of the machine should be included. It will be helpful to the analyst to know the operating pressure and temperature of the system.



THE ACTUAL NEUTRALIZATION NUMBER is not as important as its rate of increase. The neutralization number may rise very slowly as shown by curve B until it reaches a certain point according to the quality of the oil and its general condition. Beyond this point the neutralization number rises suddenly and the oil deteriorates rapidly. With some premium quality oils, the neutralization number rises at a slightly higher rate as shown by curve A, but the breaking point is less critical. Curve C indicates an inferior oil. It is necessary to know where the oil has progressed on the curve in order to place any significance on neutralization number.

ANALYSIS REPORT

After examination of the oil sample, the analyst will provide a report of his observations. If this work is done by your petroleum supplier, his representative should discuss his report of the analysis. This report should be filed to maintain a record of the performance of the machine and oil. Such a record will aid in determining how long the oil may be kept in service in a particular machine.

SELECTING THE OIL

The most effective use of the hydraulic fluid comes from selecting the proper oil and maintain-

ing it in suitable condition. If cheap oils of poor quality are used, elaborate precautions must be taken to maintain low operating temperatures, prevent contamination, and establish frequent and regular drain periods. These oils cannot be left in service for long periods, since they do not have the stability to withstand the conditions found in hydraulic systems. Intermediate quality oils are often used in hydraulic systems, particularly where external leakage is difficult to control, or where excessive contamination from soluble oil occurs. However, even in systems which may be kept relatively clean, hydraulic oils of this intermediate quality must also be drained at regular intervals, since they are not designed to maintain their original properties indefinitely.

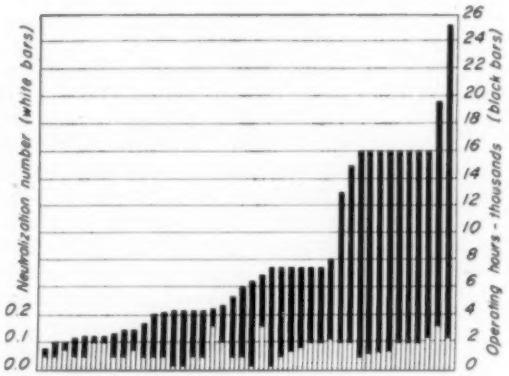
The most economical operation of a hydraulic system results from the use of a premium quality hydraulic fluid which may be left in service indefinitely. The combination of base stock and additives in such products is designed to withstand, to a substantial extent the oxidizing influence of the temperatures and materials common to hydraulic circuits.

KEEPING THE OIL IN SERVICE

Even with premium oils, preventive maintenance is essential. Reasonable operating temperatures should be maintained either by circuit design or coolers. JIC Hydraulic Standards recommend a maximum reservoir temperature of 130 degrees F, but some premium quality hydraulic fluids may be used satisfactorily to temperatures of 150 degrees F or even higher.

The reservoir should be designed to minimize the possibility of external contaminants entering the hydraulic system. A well designed reservoir will be completely tight except for an adequate breather which should be equipped with a filter.

Adequate records of repairs to the system and the amount of make-up and condition of the hydraulic fluid should be maintained. Leakage should be controlled as much as possible. Improvements in the design of tubing, fittings, packings, and sealing materials have progressed to the point where leakage is a matter of preventive maintenance.



RUST AND OXIDATION inhibited oils often have an initial neutralization number of .05 to .10 as measured by ASTM methods. With proper maintenance, these oils may be used for thousands of hours. Premium quality hydraulic oils containing special additives may have an initial neutralization number as high as .8. The chart shows the long service which may be secured with premium oils when kept clean. There is little correlation between the neutralization number and length of service.

In determining whether oil should be changed, the cost of taking a sample and making a laboratory analysis must be balanced against the cost of a new oil charge. In a small system, it may be easier and more economical to discard the oil at regular intervals. However the conclusion that your oil must be drained at regular intervals should be reached only after analyzing characteristics of the oil. It is not sufficient merely to check the product for color and neutralization number; these must be evaluated along with other significant tests. ▼▼▼

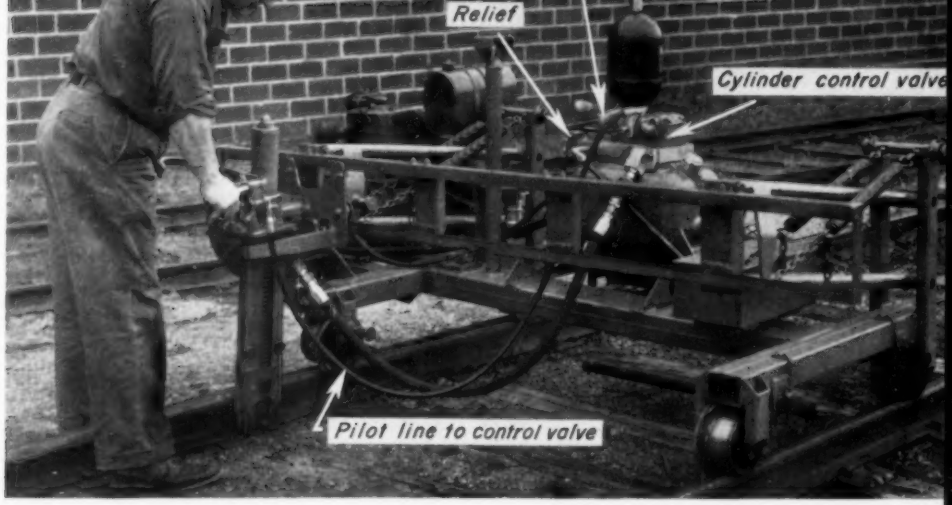
R. Q. Sharpe

About the author . . .

Bob Sharpe's experience with industrial hydraulics extends over fourteen years. He moved to Socony-Mobil Oil Company's headquarters in New York in 1946 after working out of their Chicago office as lubrication engineer and assistant chief engineer. Today, as Senior Engineering Representative, he provides men in the field with technical information they need for marketing and service. He also works closely with the laboratories on product developments to meet the needs of industry.

This article is Bob's second for AH. In October 1953, he authored the article, "Do You Need Inhibited Oils?"

head. Now, ready for pulling action, pressure build-up causes the pilot check to open and admit power from the accumulator to be added to pump delivery



AN ACCUMULATOR PERMITS using a smaller engine and pump to reduce size and operating costs. Complete control of the spike pulling operation is from a valve, on the handle bars, gripped by the operator.

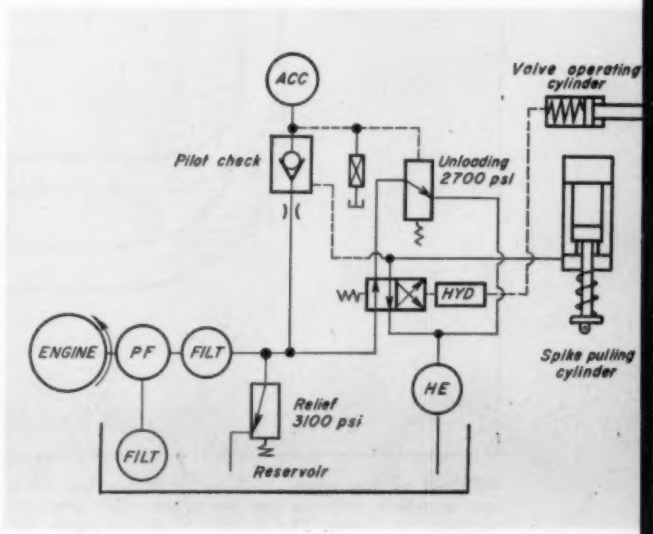
PILOT CHECK TIMES ACCUMULATOR ACTION

. . . on spike pulling machine

SEVERAL good circuit ideas are a part of the redesign of a machine used to pull spikes from rail ties.* This machine moves along railroad tracks pulling out a spike about every 3 seconds. Fast action of a 6 inch pulling stroke makes the job a natural application for an accumulator. The circuit redesign by Farimont Railway Motors, Inc., features the addition of a pilot operated check valve which results in better utilization of power from the accumulator.

A second important new feature is the use of a two stage cylinder. This two stage design also helps to increase efficiency by doing the job with less

*Design of the hydraulic system on the original spike puller was described in APPLIED HYDRAULICS, August, 1952.



HIGH SPEED operation of this hydraulic circuit does result in heat. A fin type heat exchanger helps dissipate most of it. The two stage pulling cylinder, by reducing oil requirements, helps reduce heat.

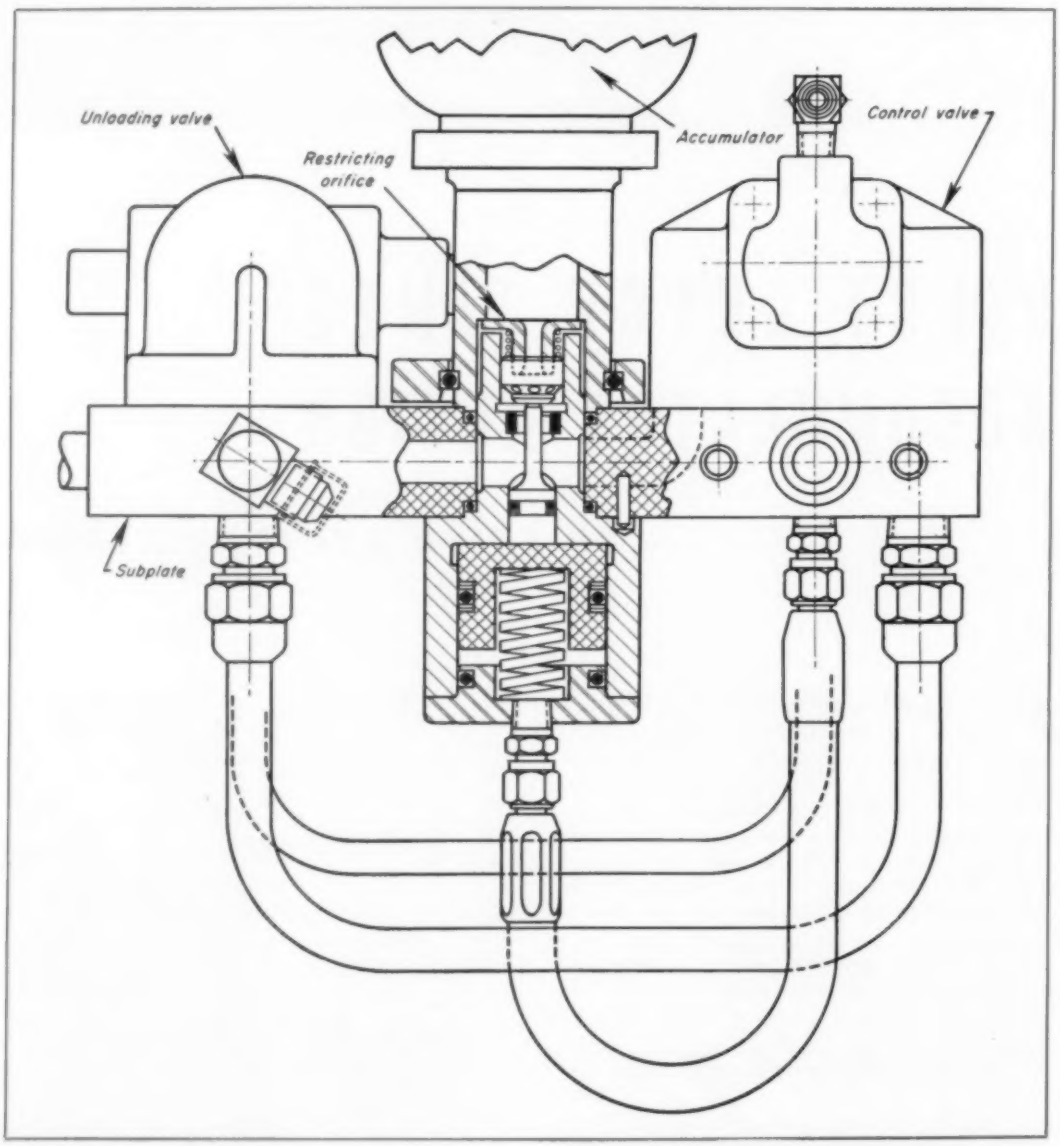
REPLACING a single piston cyl-

SPIKE PULLER DESIGN

oil. These two features play a big part in increasing the work capacity from the 8 to 12 spikes per minute obtained with the original design to 15 to 20 spikes per minute.

A study of the circuit schematic drawing shows the important job of the pilot operated check. The operator controls spike pulling by squeezing the "valve operating cylinder" mounted on his "bicycle grip" handle. Shifting of the 4-way valve directs oil from the pump to the spike pulling cylinder. The spike pulling jaws move in to clamp on the spike head. Now, ready for pulling action, pressure build-up causes the pilot check to open and admit power from the accumulator to be added to pump delivery for fast spike pulling action. When the spike is removed, the operator releases the valve operating cylinder permitting the two position 4-way valve to be spring returned. The pilot check closes and the single spike pulling cylinder returns.

The pump recharges the accumulator to the pressure of the unloading valve. When the machine is idling, with the pump running, minimum power is taken from the internal combustion engine because pump delivery is bypassed back to tank through the



DESIGN of the pilot check valve makes use of a spring which reduces the necessary pilot pressure to open the check. The restricting orifice above the check valve prevents shock when accumulator energy is released. Mounting all valves on a subplate simplifies the piping.

REPLACING a single piston cylinder with this two stage design is a major improvement. Force requirements for spike pulling make the oil saving design practical.

unloading valve at a pressure which is only equal to the resistance in the line through the unloading valve back to tank.

The layout drawing shows the manifold mounted valves and a section through the pilot operated check valve in-line with the accumulator. The spool in the pilot valve is shown in the position taken during pulling. Oil flows from the accumulator through the holes in the check valve. The spring assisting the movement of the large spool which in turn opens the check, makes the action more sensitive. It was found that without the spring, and when pulling spikes from old and rotten ties, oil pressure in the pilot line was not sufficient to raise the check off its seat until near the end of the pulling stroke. Addition of the spring reduced the required oil pilot pressure and insured earlier action of the accumulator.

A restricting orifice, above the check in the accumulator outlet, prevents too violent action taking place at the moment the check is raised.

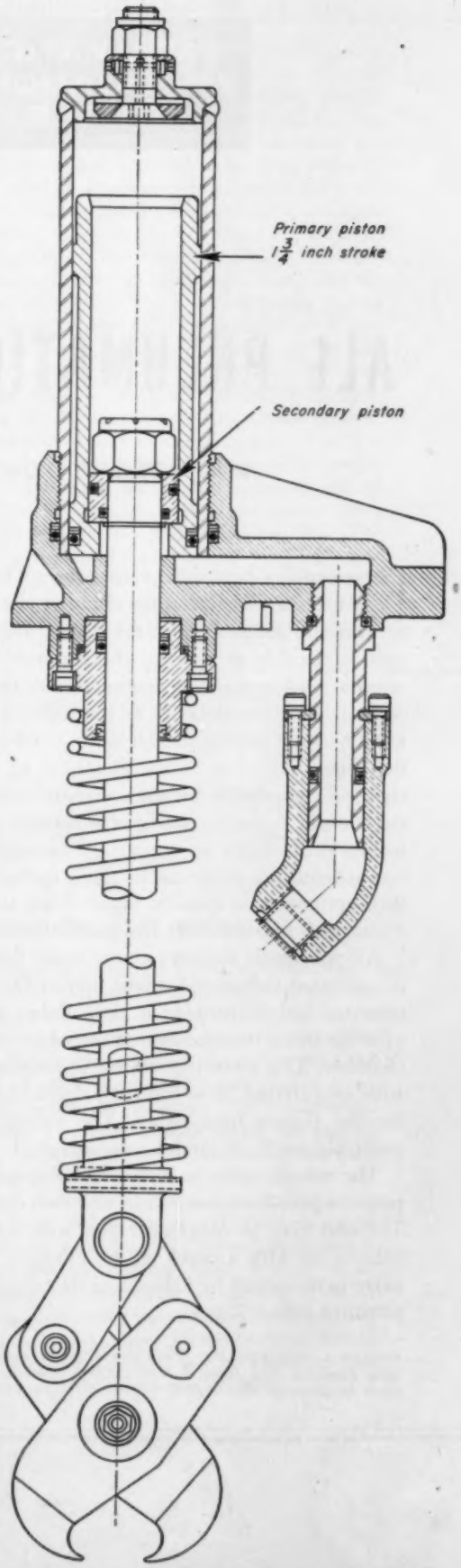
Not only does the addition of the pilot check conserve accumulator energy during a normal cycle, it also makes it possible for the operation to be stopped and restarted without discharging any of the accumulator oil if the spike has not been gripped securely or if the spike is completely missed by the jaws. Because the jaws grip the spike before release of energy from the accumulator, life of the jaws has been increased.

PULLING CYLINDER DESIGN

A study of the force requirements for pulling the spike made it possible to design a two stage cylinder which requires approximately one half the amount of oil used for full stroke of a single stage cylinder.

Force requirements for this spike pulling job call for an initial high force to break the spike loose and then a lower force for the remainder of the pulling stroke. A two stage cylinder presents a large area to oil pressure for the initial high force portion of the stroke and then a smaller area to give a reduced force. The spike pulling cylinder, detailed in the cross-sectional drawing, has a 2½ inch outer piston which makes a relatively short stroke of 1¾ inch. This short stroke is limited by the upper end of the piston making contact with the head end of the cylinder. During this short stroke the outer piston and the 1¾ inch diameter inner piston move as a unit. Maximum pulling effort is supplied to loosen the spike from the tie and start it on its way. When the outer piston completes its travel, the small piston

Concluded on page 78



PNEUMATIC APPLICATION ARTICLE

Is electrical control really necessary in your pneumatic design? Frequently a lower cost and reduction of maintenance can be achieved with . . .

ALL PNEUMATIC TIMING CIRCUITS

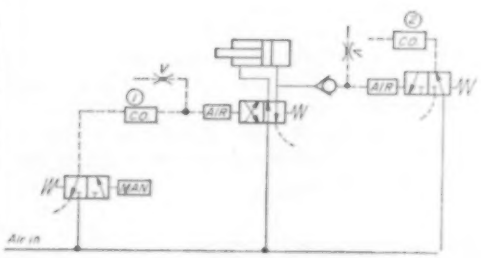
• By William J. O'Connell

IN present-day pneumatic circuit design there is a tendency in all but the simplest circuits to overlook all-pneumatic operation. This is most noticeable in circuits where remote operation must actuate an automatically timed control, or where delayed or intermittent operation is necessary. Under such conditions the general trend is to use electrical or mechanical components for the automatic part of the control. Although machine sequences controlled with these electrical or mechanical components are accurate in their operation, this equipment is usually higher than pneumatic units in component and installation cost.

All-pneumatic timing circuits make use of air-operated valves and cutout valves. The air operated valves provide a time delay with pilot air being metered into or out of the pilot chamber. This metering can be accomplished with an external flow control valve adjusted for the proper time delay. The valves are available for 2-, 3-, and 4-way operation.

The cutout valve is a 2-way valve which passes a preset amount of air, and then closes. The unit may be obtained either with a free exhaust or with a check in the exhaust. The valve is re-opened by exhausting the upstream pressure side. ▼▼▼

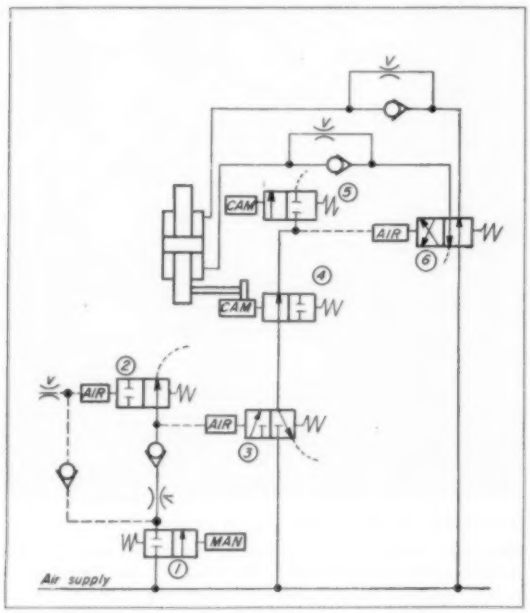
WILLIAM J. O'CONNELL *was Production Engineer with Moraine Products Div., General Motors Corp., Dayton, Ohio when he prepared this article.*



CYLINDER ACTUATION FOLLOWED BY BLOW-OFF

Operating the manual valve actuates the 4-way valve to extend the cylinder. This in turn operates the 3-way pilot operated valve to exhaust air ahead of cutout valve 2. After cutout valve 1 closes, air in the 4-way valve pilot chamber begins a timed exhaust through the flow control valve. When sufficient air has exhausted, the valve deactuates. The cylinder then retracts and the 3-way valve begins a timed exhaust. When the pilot chamber is exhausted, the valve opens permitting a specific amount of air to pass through cutout valve 2, after which the cutout valve stops the flow of air. Because of cutout valve 1, the cycle will be completed whether or not the manual valve is released. However the manual valve must be released and reactuated to repeat the cycle.

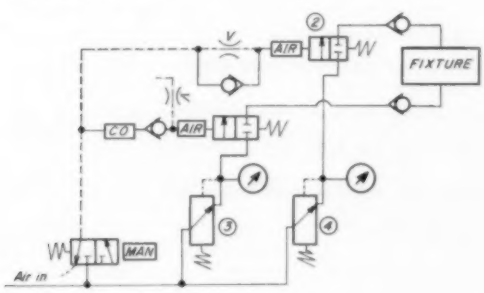
LIMITED RECIPROCATION

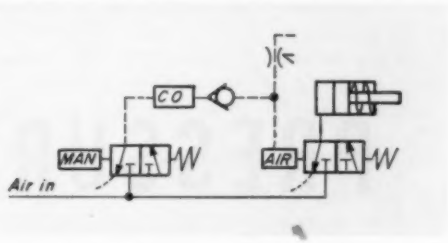


In an indexing type assembly where a specific number of strokes is required to perform an operation, this circuit can be used. Actuating manual valve 1 applies pilot air to valves 2 and 3. This closes valve 2 and actuates valve 3 connecting the air supply through actuated valve 4 to valve 6. While valve 6 is deactuated, it maintains the cylinder in the position shown. When valve 6 is actuated, the cylinder moves to the other end of its stroke actuating valve 5 and deactuating valve 4. Valve 4 closes and valve 5 opens exhausting the air chamber of valve 6 which returns to its spring loaded position. The cylinder again reverses, and this reciprocating action continues until the air chamber of valve 2 has exhausted sufficiently to allow the valve to be spring returned to its open position. This is timed by the flow control valve in the exhaust of valve 2 air chamber. Valve 3 is then deactuated, so that valve 6 returns to its spring loaded position and the cylinder comes to rest in the position shown. Actuation of the manual valve need only be long enough to begin the cycle. The number of strokes of the cylinder is set by adjusting the flow control valve in the exhaust of valve 2. The flow control valve between valve 1 and valve 2 permits a pressure build-up to actuate valve 2.

APPLICATION OF TWO AIR PRESSURES

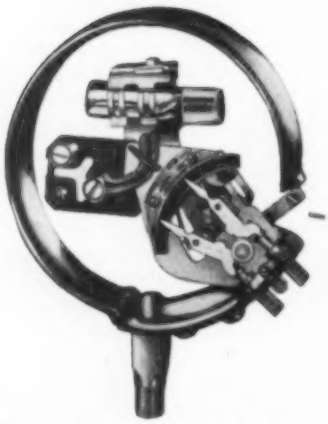
This circuit can be used to apply two different air pressures successively, such as on a go/no-go leak test. Operating the manual valve connects pressure air to valve 1 which opens and connects the fixture to air pressure regulated by valve 3. After the cutout valve has passed its preset amount of air, it closes permitting the pilot air chamber of valve 1 to exhaust through the flow control valve. The circuit is adjusted so that after valve 1 closes, air pressure has built up sufficiently in the pilot chamber of valve 2 to open the valve and connect the fixture to air pressure regulated by valve 4. The manual valve is then released allowing valve 2 to be spring closed after a time delay determined by the flow control valve.



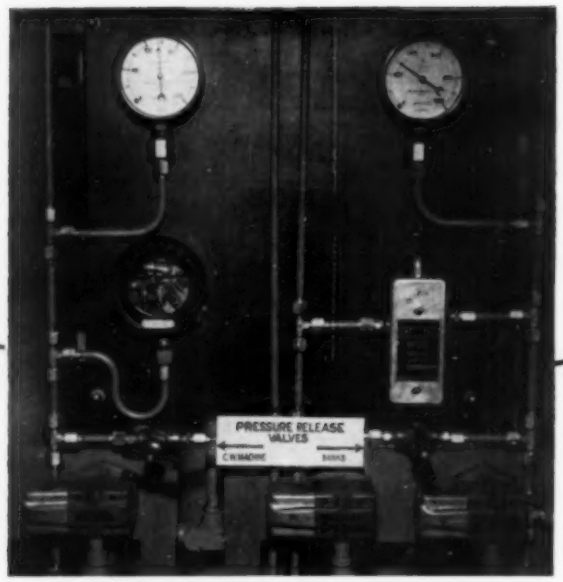


TIMED CYLINDER OPERATION

The circuit is shown for a single-acting cylinder, but it can be modified for a double-acting cylinder by using a 4-way, pilot-operated valve in place of the 3-way valve. Actuation of the manual valve sends a specific amount of air through the cutout valve and into the air pilot chamber. This actuates the 3-way valve to extend the cylinder. The cutout valve closes after a specific amount of air has passed, allowing the pilot chamber to exhaust through the flow control valve. When sufficient air has exhausted, the 3-way valve is spring returned allowing the cylinder to retract. The manual valve need not be held down for the entire cycle, but only long enough to actuate the pilot-operated valve. It must be released and then reactuated for a new cycle. A specific application for this circuit is the conversion of continuous-action clutch presses to single action. This arrangement is simpler and less expensive than many package installations now available.



THIS BOURDON TUBE PRESSURE SWITCH incorporates a tilting type mercury switch rated at 10 amperes 115 volts.



TWO-PRESSURE HYDRAULIC SYSTEM for operating 12 clamping tools is controlled by pressure switches which operate when accumulators are charged to clamping pressure. Solenoid valves then unload pump output.

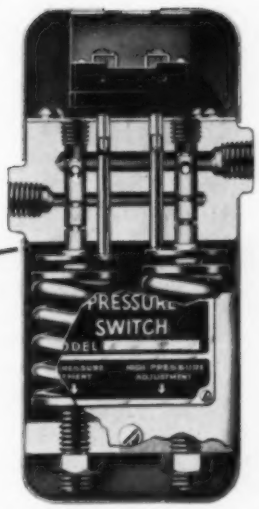
PRESSURE SWITCHES

. . . for fluid power control

• By Allan E. Morris
Associate Editor APPLIED HYDRAULICS

Frequently the best way of sequencing operation on hydraulic equipment is by use of a pressure switch which actuates a timer, solenoid valve, or relay when the system pressure rises or falls to a preset value. In addition to sequencing, the pressure switch can maintain correct pressures, and can act as a safety feature.

***PART I** . . . of a two-part article, this discussion covers main features of pressure switches and gives information for their proper selection. Next month, Part II by Kenneth Rexford, Chief Engineer, Electrical Dept., Hydraulic Press Mfg. Co. will present circuits and specific fluid power applications of pressure switches.*



THIS PLUNGER TYPE PRESSURE SWITCH has separate switches for high and low pressure control.

A PRESSURE switch consists of a pressure-actuated mechanical device and an electric snap switch. The pressure device can be either a bellows, piston, or bourdon tube depending on the pressure range and type of service. The switch is usually single-pole, double-throw rated for 10 or 15 amperes at 110 volts a.c. Either one or two switches may be incorporated in the unit.

Because of the characteristics of the snap switch, pressure switches have a certain overlap between the point at which they actuate with increasing pressure, and the point they are deactuated with decreasing pressure. In a typical piston-actuated switch, this difference is 85 psi at a setting of 200 psi and 325 psi at a setting of 1000 psi. In another switch of the same type, the pressure difference is 100 psi at a setting of 200 psi and 700 psi at a setting of 3000 psi.

In applications where the pressure switch is required to act on pressure between closer limits, it is necessary to use two pressure switches—one for the upper limit and one for the lower limit—or a combination switch which senses two pressures.

TYPE OF PRESSURE SWITCHES

Three types of pressure switches are available for fluid power applications.

Bellows-type pressure switches are designed for pressures to 300. At typical unit has a range from 1 to 115 psi with a minimum differential of 6 psi.

Piston-actuated pressure switches are rated for pressures to 10,000 psi and employ a closely fitted steel piston operating in a steel cylinder to provide the actuating force for the switch. A strain relief mechanism may be incorporated, so that the pressure switch can absorb the impact of a violent pressure surge. Seals may be installed on the piston to eliminate leakage. They are not used, however, when friction must be held to a minimum on units for low differential pressures. If fluid does leak past the piston, provisions must be made to return this to tank to prevent back pressure.

Bourdon tube pressure switches operate on the same principle as pressure gages. Mechanical motion is achieved by the expansion of the curved tube when pressure fluid is admitted. Pressures for bourdon tube pressure switches range from 15 psi to 10,000 psi. These have a repeat accuracy of 2% and a pressure difference between actuation and deactuation from 10 psi minimum at 400 psi actuation to 2000 psi maximum at 10,000 psi actuation.

DIFFERENTIAL PRESSURE SWITCHES

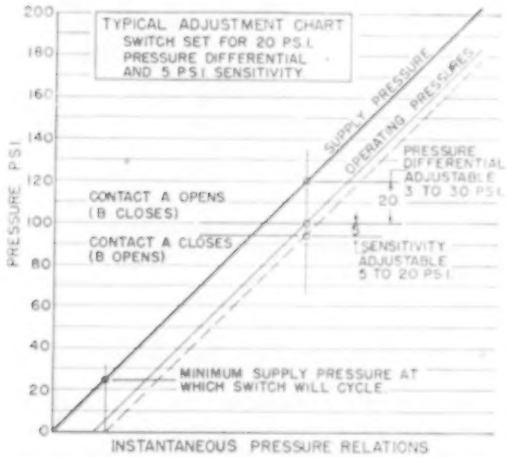
When the difference between two pressures must be maintained, a differential unit is used. This type is particularly applicable to certain welders where frequent adjustment of the pressure regulating valve would require correspondingly frequent adjustment of the pressure switch setting. However the differential pressure switch automatically adjusts itself to the change in supply pressure to assure a preset difference between the two pressures.

Differential pressure switches are also used with filters where they sense the pressure drop across the filter. An increase of this pressure to the setting of the pressure switch indicates that the filter is clogged and should be cleaned or replaced.

One type of differential pressure switch employs two bellows which work in opposition. A spring is used in addition to the lower pressure bellows. Spring compression is adjusted for the proper difference in the two pressures.

An adjustment graph for differential pressure is shown on the next page. The pressure switch is set for a 20-psi pressure differential and a 5-psi sensitivity. With the supply pressure at 120 psi, a vertical line through this point indicates that the switch will operate when the operating pressure

drops below 95 psi. A vertical line through any other supply pressure will indicate the operating pressure at which the switch operates. The lowest supply pressure at which a differential pressure switch operates is the differential pressure setting plus the sensitivity setting. In this example this value is 25 psi.


TYPICAL ADJUSTMENT CHART
SWITCH SET FOR 20 P.S.I. PRESSURE DIFFERENTIAL AND 5 P.S.I. SENSITIVITY
SUPPLY PRESSURE
OPERATING PRESSURE
PRESSURE DIFFERENTIAL ADJUSTABLE 3 TO 30 P.S.I.
CONTACT A OPENS (B CLOSES)
CONTACT A CLOSES (B OPENS)
SENSITIVITY ADJUSTABLE 5 TO 20 P.S.I.
MINIMUM SUPPLY PRESSURE AT WHICH SWITCH WILL CYCLE
PRESSURE P.S.I.
INSTANTANEOUS PRESSURE RELATIONS

ADJUSTMENT CHART for differential pressure switch indicates pressures at which switch will operate. Switch is set for a pressure differential of 20 psi and a tolerance of 5 psi.

MANUAL RESET PRESSURE SWITCHES

Pressure switches which are particularly applicable as safety devices are designed so they must be manually reset after actuation. They are actuated by a pressure either below or above the preset pressure. When the switch is actuated, it in turn actuates electrical devices to warn of the condition. In order to reset the pressure switch, the cause of the trouble must be corrected.

SELECTING A PRESSURE SWITCH

Selection of the proper pressure switch can be a simple matter if several factors are clearly understood. Proof or withstand pressure is the maximum value that the switch can withstand before distortion of the pressure sensitive member occurs. The maximum system pressure or any surge pressure must not exceed this proof pressure rating of the switch. Pressure switches for application in hydraulic circuits are frequently protected against surge pressures, so that they are not actuated by these transient pressures. Snubbers are sometimes used to protect pressure switches from surges. These snubbers introduce a restriction in the flow circuit to the pressure switch and consequently increase the friction and pressure drop. One form of snubber is called a restrictor and is essentially a small orifice. Porous materials have been used for snubbing, but these are subject to clogging. One good method of protecting against surges is to use a long, capillary type tube to connect the switch to the pressure source. This should be as long and have a small a diameter as practical.

Several adverse effects may occur when surge is not protected against in pressure switch circuits. Where a pulsating source of pressure such as that produced by a piston pump acts against the elastic head of a gas-charged accumulator, considerable oscillation may occur. The magnitude of this oscillation can be greater than the degree of control required, causing a rapid cycling of the system.

When the hydraulic system actuates heavy cylinders, pressure can build up to an unusually high value before movement of the cylinder begins. With a pressure switch set for the pressure with the cylinder moving, the initial pressure could shut off the flow before the cylinder moves. When the cylinder does begin to move, its inertia may cause it to overtravel. The pressure would then drop rapidly and the pressure switch would again start flow to the cylinder. As a result of this irregular pressure control, the equipment would not operate smoothly.

A second specification to consider when selecting a pressure switch is the adjustable range. On most units the upper limit of this range is 80% of the proof pressure. The switch can be adjusted to open or close the circuit at any desired actuation point on increasing or decreasing pressure within this range.

Two additional considerations are the electrical rating and selection of the differential pressure between actuation and deactuation. Because of the wide selection of operating range and differential, a standard unit usually can be found to satisfy the requirements of the application.

Mechanical friction losses which are not constant are inherent in many types of pressure switches. Because these vary between operations, actuation will not always occur at the same pressure. A tolerance should always be included in the specifications of a pressure switch to ensure the accuracy required.

PROTECTION OF CONTACTS

When pressure switches are required to operate frequently, the contacts can be protected and their life prolonged by a series resistor-capacitor combination in parallel with the contacts. The parallel combination should be connected as closely as possible to the contacts.

To determine the values of the resistor and capacitor, the following formulas can be used:

$$C = \frac{I^2}{10} \text{ Microfarads} \qquad R = \frac{E}{10I\left(1 + \frac{50}{E}\right)} \text{ ohms}$$

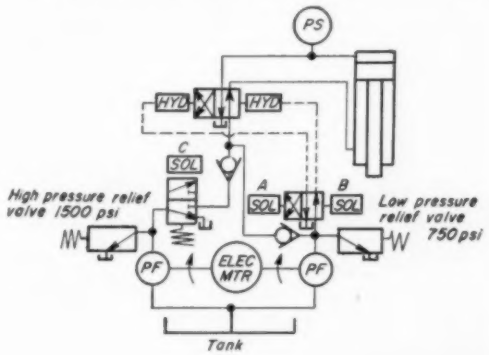
Where I = load current in amperes immediately before opening the contacts.
E = source voltage immediately before closing the contacts.

For voltages less than 50 volts, and for currents

Concluded on page 64

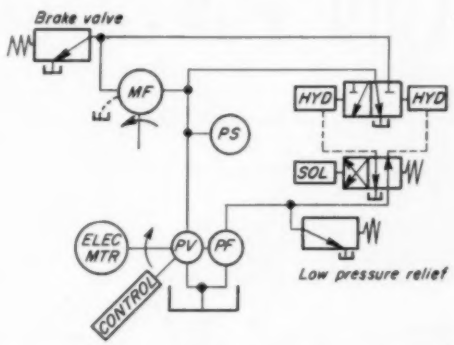
3 Typical Pressure Switch Applications

TWO PRESSURE CIRCUIT: Use of a pressure switch to actuate solenoid valves in circuit 1 provides two pressures for operation of the cylinder in the high-force, extend stroke and the low-force, retract stroke. The two pumps are connected to a common point through check valves. The high pressure pump operating at 1500 psi can be unloaded through the 3-way solenoid valve. Output from the other pump operating at 750 psi operates the 4-way pilot operated valve as well as the main cylinder. In the positions shown, the cylinder is being held up by 750-psi oil while the high pressure pump is unloaded at near zero pressure through the 3-way valve. To start downward travel, operation of a pushbutton shifts the 4-way solenoid valve. This directs oil from the low pressure pump to shift the pilot operated valve beginning the downward stroke of the cylinder at low pressure. When the cylinder contacts



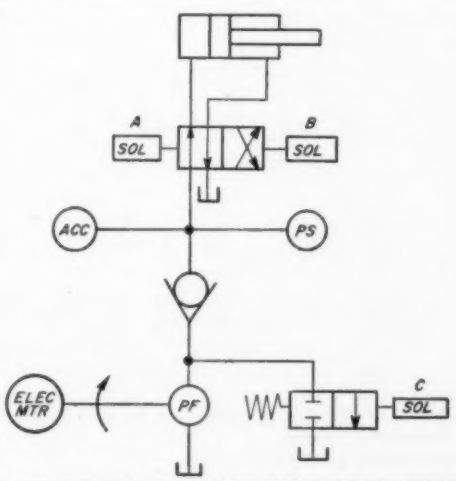
the work and the pressure builds up to the setting of the pressure switch, the 3-way solenoid valve is actuated to direct flow from the high pressure pump to the blank end of the cylinder.

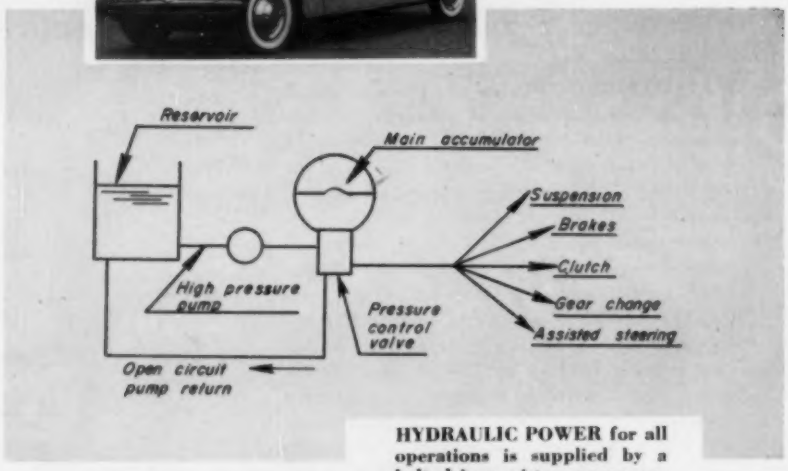
OVERLOAD PROTECTION: The pressure switch in circuit 2 acts as a protective device for the fluid motor. The variable volume pump driving a fixed displacement motor provides a constant torque, variable speed drive that is applicable to web processes such as the manufacture of paper, rubber, and fabric. An auxiliary fixed volume pump supplies fluid for operation of the pilot operated 3-way valve. The solenoid valve is controlled by the pressure switch. Under normal conditions, the discharge from the motor is through the pilot operated valve to tank. If the load on the motor becomes excessive, pressure at its input increases to the setting of the pressure switch. This actuates the solenoid valve to shift the pilot operated valve. This blocks the normal discharge circuit of the motor and unloads the pump. The motor



then acts as a pump discharging through the braking valve until it stops.

PUMP CUT-OUT: Horsepower savings and cooler operation are accomplished by use of a pressure switch functioning with an accumulator in clamping circuit 3. When solenoid *A* is actuated, the pump delivers fluid through the 4-way solenoid valve to extend the cylinder. When the cylinder is fully extended, pressure builds up in the accumulator until the setting of the pressure switch is reached. At this time the switch is actuated to energize solenoid *C* unloading the pump at near zero pressure. The accumulator then maintains the cylinder fully extended. If accumulator pressure drops because of leakage, the pressure switch is deactuated to close the unloading valve and connect pump output to the cylinder. When the 4-way solenoid valve is reversed, pump output retracts the cylinder. The pump is then unloaded until a new cycle is initiated.

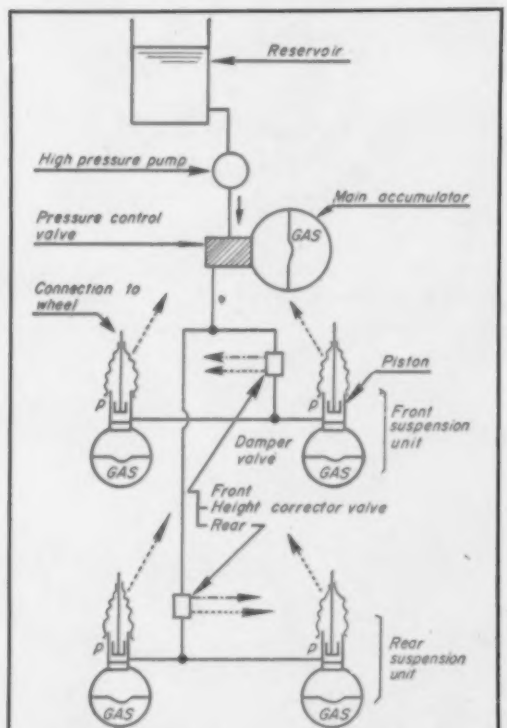




HYDRAULIC POWER for all operations is supplied by a belt driven piston pump operating at 2000 psi.

Where's the place for . . .

FLUID POWER ON AN AUTOMOBILE?



Wheel suspension is controlled by this hydropneumatic system.

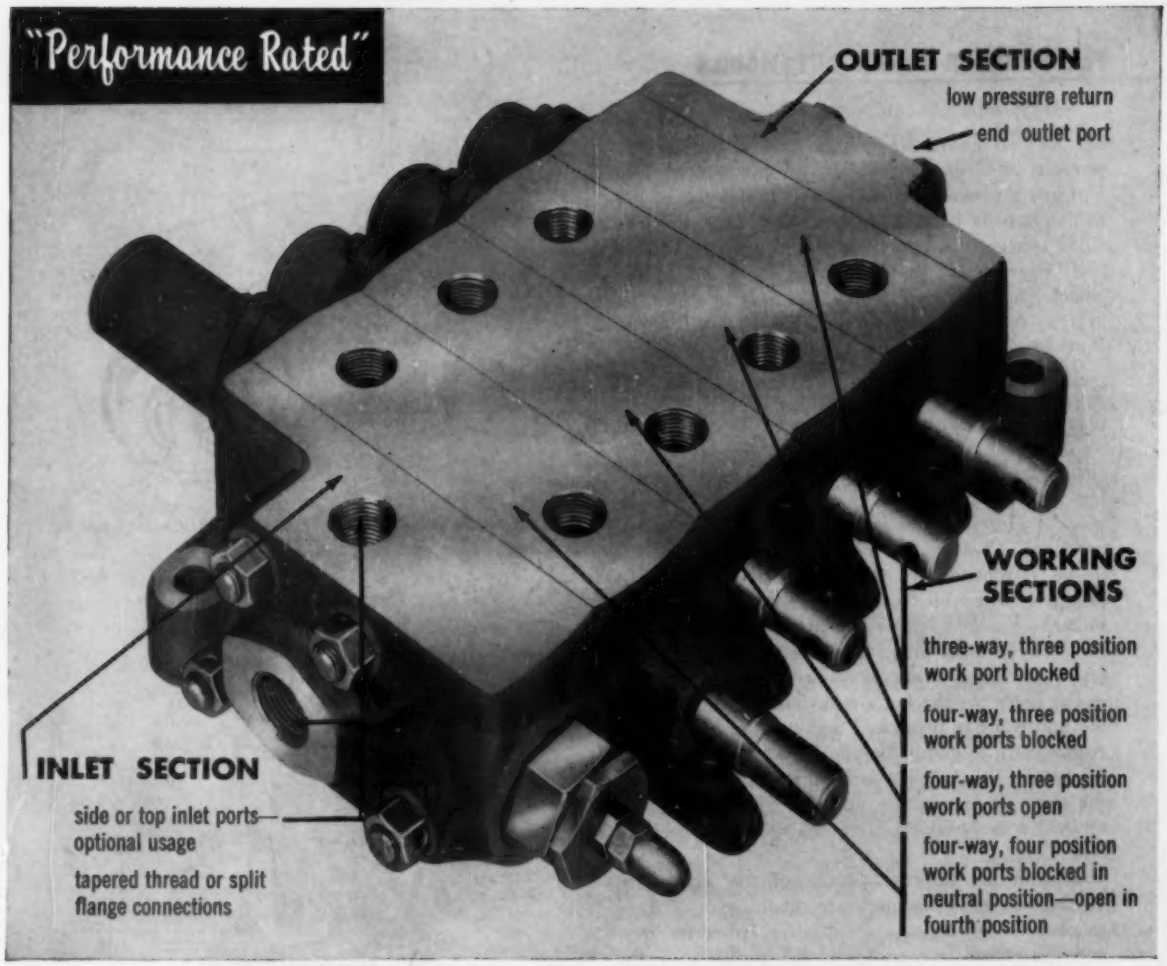
By John A. Lankester
European Editor, APPLIED HYDRAULICS

MAKERS OF the French Citreon DS 19 are using fluid power for basic functions. This unconventional design provides fluid power to simplify and take fatigue out of driving.

You can't help but draw comparisons between this French design and American automobiles. All U.S. cars have hydraulic brakes and can supply power steering. In this country the switch from mechanical gear shifting to the hydrodynamic transmission is almost complete. Therefore, no American car producer has made the combination of hydrostatic power and a mechanical transmission as the French have done. Does the French transmission yield greater economy and at the same time reduce operator effort?

1 RIDING ON AIR

A system of hydropneumatic pressure vessels has been devised to control the suspension or springing of the road wheels. All four wheels are independently carried on swinging arms which are connected to hydraulic pistons housed in cylinders. Each cylinder is piped to a spherical cham-


"Performance Rated"
OUTLET SECTION
low pressure return
end outlet port
WORKING SECTIONS
three-way, three position work port blocked
four-way, three position work ports blocked
four-way, three position work ports open
four-way, four position work ports blocked in neutral position—open in fourth position
INLET SECTION
side or top inlet ports—optional usage
tapered thread or split flange connections

NEW DIRECTIONAL CONTROL VALVES DO THINKING FOR CYLINDERS AND MOTORS

Every working section of these new valves has its individual built-in check which blocks against all return flow until the return pressure is overcome by pressure build up from the pump. This means that irrespective of the number of working sections which may be in operating position no load drop can occur. Danger resulting from erratic operation or one load dropping while another is being positioned is eliminated. Not even the slightest pre-lift drop can occur as a load is being positioned.

Other important new features have been incorporated in these new valves which reduce their internal pressure loss. Internal passageways are larger, of more uniform cross section, free from abrupt change of direction and have smoother wall surfaces. Spools are solid and without internal restriction. Thus constriction to flow inside these valves is less than other valves and their pressure drop has been improved as much as 15%. All sealing between sections and at ends of spools is by O-rings instead of gaskets, so now you can use these valves at working pressures up to 2000 psi and have trouble free, leak proof operation with the timing action so exact and precise that "inching" loads to exact position is a stable operation.

Safety protection for the hydraulic system, plus overload protection for the structural members and tools of the machine in operation, are provided by a new combination overload relief-pressure control valve. It is built into a complete cartridge and is easily removed as a unit from the inlet section of the valve bank. Thus inspection of this important sentinel is easy and replacement can be accomplished in a matter of minutes.

Available in three sizes, you will find these new "B" series valves have higher performance ratings than other valves. To assist you in selecting the size best suited for your application, data is available to show their internal pressure drop for different volumes of flow under varying operating pressures as encountered in actual operation.

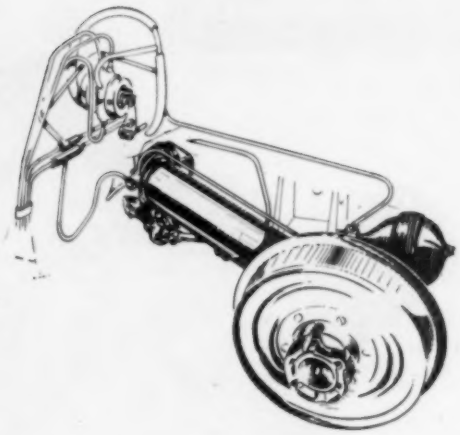
Write to Dept. A-31, The Commercial Shearing and Stamping Company, Youngstown, Ohio; Chicago, Illinois; Salt Lake City, Utah.

COMMERCIAL
shearing and stamping

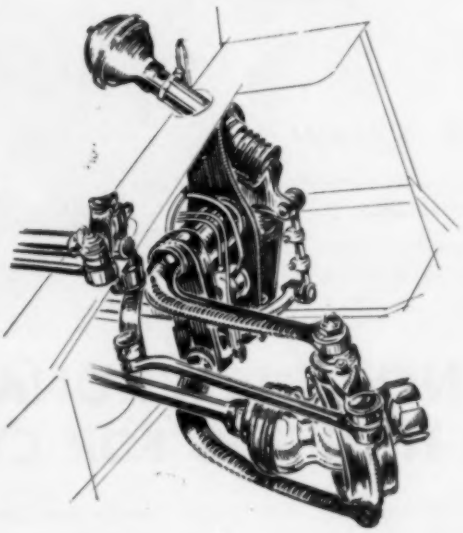
ber divided across its diameter by a rubber diaphragm enclosing a volume of compressed gas. Upward movement of the wheel, forces the piston to displace its fluid from its cylinder into the gas-filled sphere thus compressing the gas still further and progressively cushioning the movement of the wheel. On the recoil stroke, the gas pressure reacts to return the oil to the cylinder, its rate of flow being restricted by a damper valve.

Since the oil is in effect the transmitting link between the road wheel and the resilient gas, the height of the car will be increased and decreased by changing the volume of fluid in the system. To ensure the correct height being maintained regardless of load or thermal changes affecting the volume of either oil or gas, height corrector valves are used. These valves either allow additional oil to be introduced by the engine driven pressure pump, or bleed oil from the suspension units back to tank. Valve operation is entirely automatic and the flow of fluid to or from the cylinders is governed by the position of the road wheels relative to the body. As the body sinks under a heavy load the anti-roll bar turns and actuates the height corrector valve to admit the additional fluid necessary to restore the height, and conversely rotation of the anti-roll bar in the opposite direction causes, the valve to bleed oil from the cylinders back to tank.

Though no internal details of the valve are available, a closed center valve could be used here to couple the suspension cylinders either to pressure or return according to the position of the spool governed by the relative position of the body and wheels.



Rear suspension showing hydropneumatic components.

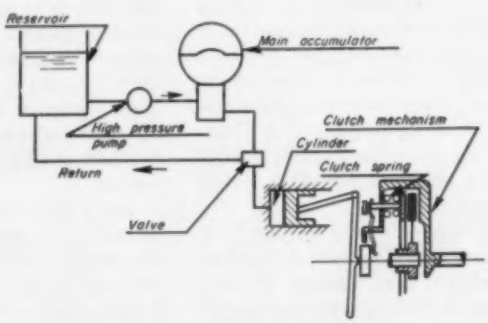


Front suspension.

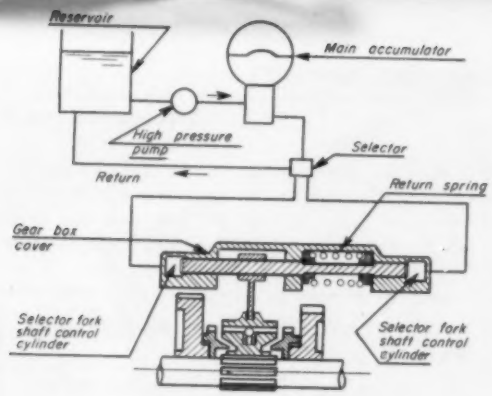
2 NO CLUTCH PEDAL

For the operation of the clutch, the conventional pedal is replaced by a hydraulic cylinder, which when pressurized from the main pump accumulator system withdraws the clutch. When this pressure is released, the clutch spring bring the friction surfaces together to transmit the drive.

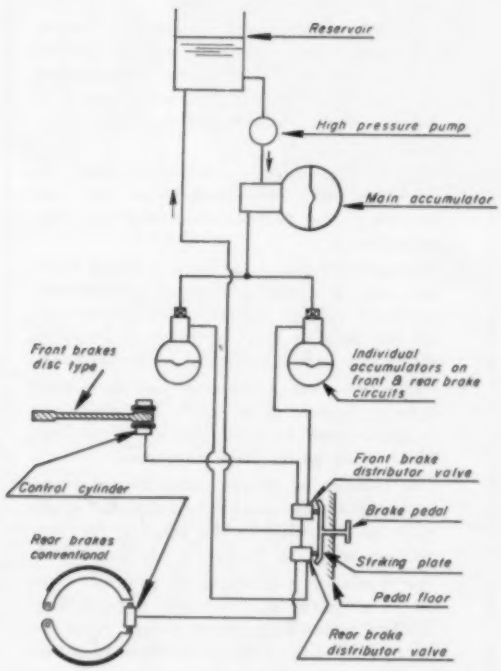
Control is effected by two mechanisms in series. One, connected to the gear shift lever, withdraws the clutch before engagement of a gear, and closes the clutch plates again after the desired gear has been selected. The other clutch control is linked to a supplementary pump which cuts in when the engine is idling to pressurize the clutch cylinder and withdraw the plates. As the accelerator is depressed, the hydraulic pressure is released, allowing the drive to take up. This action is automatically varied by the speed of accelerator pedal movement to allow for different driving techniques varying from moving off slowly to rapid full throttle get-



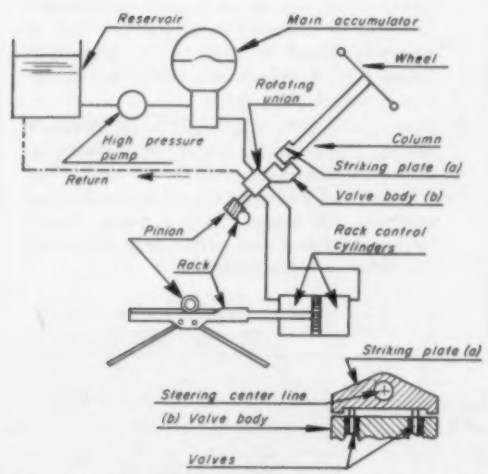
Clutch operating mechanism.



Gear shifting arrangement.



Hydraulically actuated brakes.



Layout of hydraulic power steering assist system.

away. A manual over-riding control on the dashboard can be used to release the pressure and secure the engagement of the clutch when the car is at rest with the engine stopped. This permits the car to be left in gear when parked.

3 POWERED GEAR SHIFT

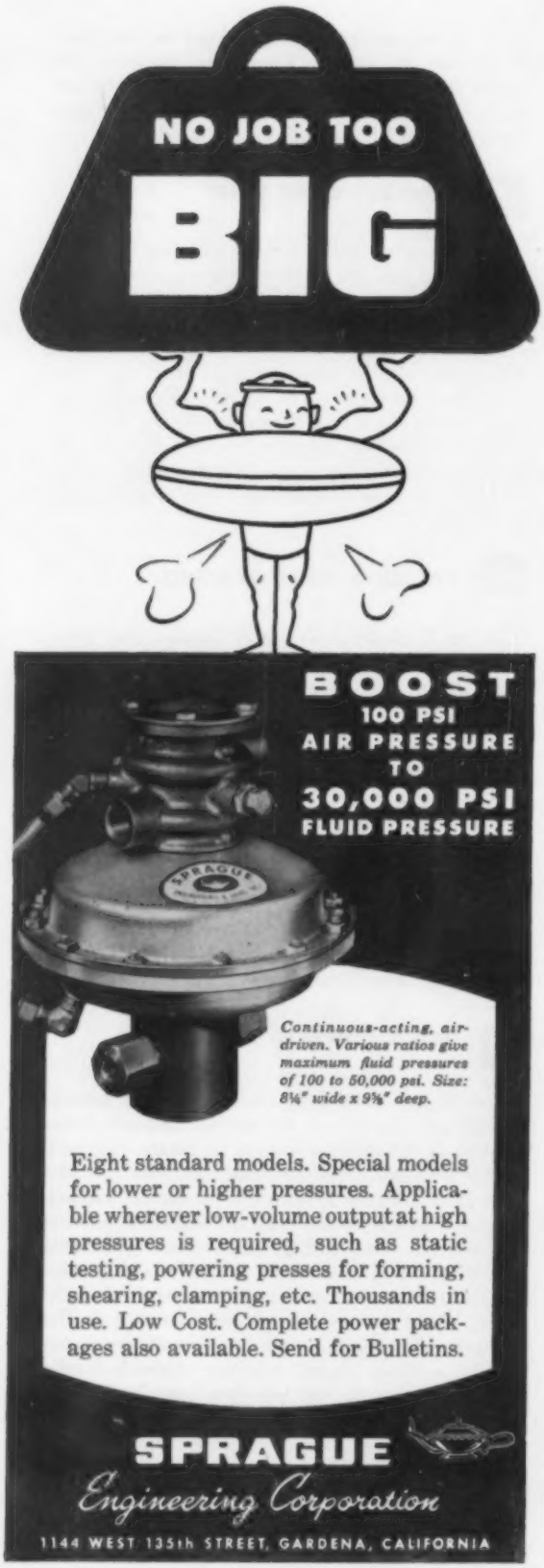
In the gearbox, the conventional levers operating the selector fork shafts have been replaced by hydraulic cylinders located at each end of these shafts. The change-speed lever, besides taking care of the clutch operation already described, actuates a selector valve to admit pressure from the main pump into the cylinder to operate whichever gear is chosen by the driver. When the selector is moved to another position, the pressure from the previous gear cylinder is released allowing the return spring to move the gear into neutral before engaging the next gear.

4 PRESSURE PUMP BRAKING

A line from the main circuit supplies high pressure oil via two hydropneumatic accumulators—one for front and one for rear—to the brake distributor valves. These valves are both operated together by the brake pedal, which is very small and resembles a headlamp dimming switch. On application of foot pressure to the pedal, the main hydraulic feed is directed from the pump and main accumulator as well as from the additional brake accumulators into the operating cylinders on each wheel. The front brakes are the disk type; rear units are drum type. Distribution of braking force is automatically adjusted between front and rear brakes to give maximum braking action under all conditions of load variation.

5 FLUID POWERED STEERING

Steering gear is of the rack and pinion pattern. Rotational motion of the pinion imparts linear motion to the steering linkage by means of a rack and it is to this component that the power operated hydraulic cylinder is attached. In normal circumstances there is no mechanical connection between the steering wheel and the road wheels. Movement of the steering wheel actuates the hydraulic valve to direct pressure from the main service to whichever side of the steering cylinder is required. The exhaust oil from the opposing side of the piston returns to tank. Should a failure of the hydraulic pressure occur, the striking plate bears against the valve body, which is piped to the system by a rotating union. The valve body turns with the rotating steering pinion to impart transverse movement, without power assistance, to the rack which in turn actuates the wheels. ▼▼▼


NO JOB TOO
BIG
BOOST
100 PSI
AIR PRESSURE
TO
30,000 PSI
FLUID PRESSURE
SPRAGUE
Continuous-acting, air-driven. Various ratios give maximum fluid pressures of 100 to 30,000 psi. Size: 8¼" wide x 9⅝" deep.
Eight standard models. Special models for lower or higher pressures. Applicable wherever low-volume output at high pressures is required, such as static testing, powering presses for forming, shearing, clamping, etc. Thousands in use. Low Cost. Complete power packages also available. Send for Bulletins.
SPRAGUE
Engineering Corporation
1144 WEST 135th STREET, GARDENA, CALIFORNIA

PRESSURE SWITCHES

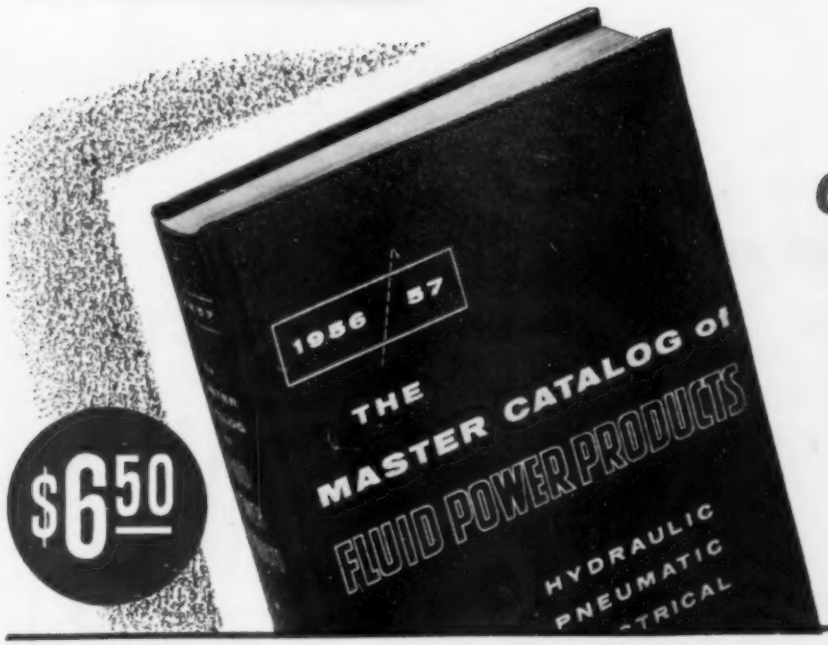
Concluded from page 58

less than 2.5 amperes, the resistor may be omitted and only the calculated capacitor connected in parallel with the contacts. At 100 volts the value of R should be within ±50% of the calculated value, but not less than .5 ohms. At 150 volts the value of R should be within ±10% of the calculated value. For higher voltages, the value of R should be as close to the calculated value as possible. ▼▼▼

WHAT FORD MOTOR CO. REQUIRES IN PRESSURE SWITCHES

1. Pressure switches for hydraulic systems operating at less than 50 psi may be of the bellows or bourdon tube type. In systems above 50 psi the pressure switch must be of the piston type.
2. Pressure switches must incorporate separate adjustments for changing the operating and differential pressures. All pressure switches must be provided with a scale to indicate the minimum and maximum pressures.
3. Hydraulic pressure switches must be equipped with restrictors to prevent operation of the switch on momentary surge pressures.
4. Pressure switches must have a metal housing with a cover gasket of oil-resistant, synthetic rubber material. Mounting holes for the housing must be external from the electrical and mechanical compartments.
5. Piston-actuated pressure switches must have a 1/8-inch drain port. This must not be connected to manifolds or other lines which may cause back pressure.
6. The bellows or piston assembly must be replaceable as a unit. Adequate space must be provided in the housing for connecting wires to terminals on the switch.
7. The minimum a-c rating of contacts must be 10 amperes at 115 volts. If current or voltage exceeding these values must be controlled, the pressure switch must be used in conjunction with a relay or motor starter.
8. Contacts must be double break, double-throw type for quick-break, quick-make. One set of normally-open and one set of normally-closed contacts is preferred. Screw type terminals are preferred; solder lugs are not permitted.
9. Nameplate data shall include (a) pressure range, (b) pressure range of differential for minimum and maximum operating pressure, (c) current and voltage rating of contacts, (d) manufacturer's name, model or type number and other data necessary to order a replacement.

From Ford Motor Co. M/g. Standards Manual



Order Now While Still Available

PARTIAL LIST OF CONTENTS OF THE TECHNICAL DATA SECTION

BASIC FLUID POWER DATA
Glossary, Abbreviations, Basic Formulas, Tables and Charts, Nomographs of basic performance and characteristics and Basic Design Problems

MACHINE CIRCUITS
J.I.C. Symbols, Commonly Used Valves, Reservoir Design Rules and Circuits grouped by basic applications—Press Circuits, Processing Equipment, Mobile Equipment, Machine Tool Circuits and Welding Circuits

COMPONENTS AND UNITS
ACCUMULATORS—Types, Applications, Selection, Typical Computations for Cylinder Operation
FLUID POWER BOOSTERS—Types, Advantages, Selections
FLUID POWER CYLINDERS—Applications, Mountings, Construction, Cushions, Force Developed, Air Requirements, Ordering Specifications
ELECTRICAL COMPONENTS—Five Design Steps for Control Systems, Electrical Symbols, Selection of Controls, Electric Motor Characteristics, Uses of Limit Switches
FILTERS—Oil, Air Filters, Representative Circuit Installations, Oil Reclaimers—Purifiers
FITTINGS: PIPE & TUBING—Flared, Flareless Fittings, Couplers, Swivel Joints
FLUID MOTORS—TRANSMISSIONS—Gear, Vane and Piston Motors, Hydraulic Transmissions
HEAT EXCHANGERS—Oil, Air Coolers, Oil Viscosity Chart, Temperature Regulation, Selection
HOSE & HOSE FITTINGS—Oil Hose, Selection and Use, Computing Length of Hose Assemblies, Air Hose, Hose Couplings
HYDRAULIC FLUIDS—Petroleum Base, Properties and Characteristics, Fire Resistant, Aqueous and Non-Aqueous Base
PACKINGS AND SEALS—Types of Mechanical Seals, J.I.C. Recommended Practices (Specifications), Backup and Wiper Rings
PUMPS—Gear Types, Vane, Piston, Reciprocating
TUBING, PIPING, MANIFOLDS—Tables of Size, Tubing Specifications, Recommended Working Pressures, Wall Thickness of Tubing, Types of Panel (Manifold) Construction
VALVES—Functions and J.I.C. Symbols of Pressure, Volume and Direction Valves

Mail This Coupon and Save Shipping Charges
ACT NOW
While They Last

The Handbook of Fluid Power

YOU GET THE FACTS WHEN YOU WANT THEM . . .

Here is a treasury of all kinds of hydraulic and pneumatic information that will help every man to save time and avoid trouble in his work. It will go a long way to improve his skill and reputation.

The Master Catalog of Fluid Power Products brings you, in one complete volume, a host of engineering and technical data—formulas, charts, diagrams, circuits and many hundreds of sources of additional data such as manufacturers catalog sheets and "Where to Buy Locally" through engineering sales agencies. You will find in the 618 pages of this indispensable volume, many facts to speed up and simplify your design, engineering and application work.

What they say . . .

"I would like to say this is a very comprehensive volume, which we will find invaluable in our Engineering Department."
GC, Chief Engineer, Montreal

"We have received our copy of the Master Catalog of Fluid Power Products and we feel that you have done an excellent job with this edition."
EDS, Pasadena, Calif.

"This catalog has been examined, and it is our opinion that it is very well prepared and will serve a very useful purpose."
SHT, Sales Manager, South Lyon, Mich.

"It is indeed a pleasure to congratulate you on your first edition."
THT, Pittsburgh, Pa.

"We certainly should like to acknowledge our sincere gratitude for the very splendid Master Catalog of Fluid Power Products for 1956-1957."
CAW, Richmond, Va.

"We feel that it's extremely well done and a wonderful thing for the industry."
HR, Los Angeles

"I just wanted to drop you a quick note to tell you what a marvelous job you people have done on the new hand book."
PL, Denver, Colorado

ORDER BLANK Master Catalog of Fluid Power Products

812 Huron Road • Cleveland 15, Ohio

Send me ..... copy(s) of the MASTER CATALOG OF FLUID POWER PRODUCTS at this Special Coupon Offer of $6.50 per copy. Postage prepaid.

☐ I enclose my check for .....
☐ You can bill me later .....

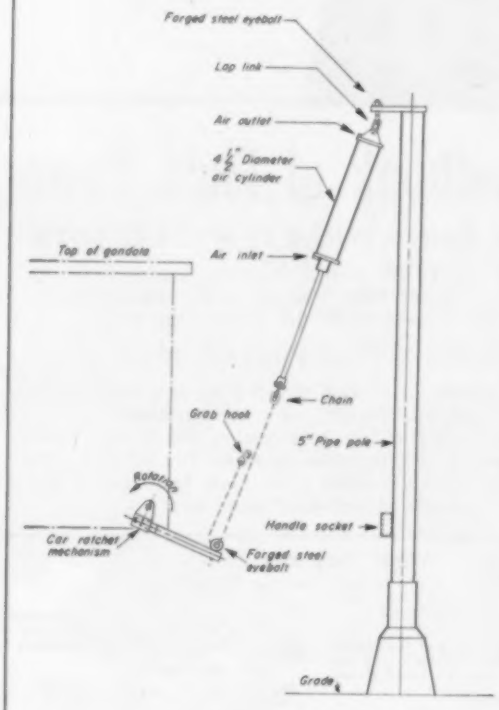
Name .....
Address .....
City ..... Zone..... State.....
Company .....
Position .....

SAVE We pay delivery costs if you send remittance with this form.

There are still many jobs using manual labor where fluid power would pay handsome profits. Here's a typical example of a job done by air which was, and probably still is in many places, a back breaking task.

For a better job use an . . .

AIR POWERED LEVER



QUITE AN AIR operated wrench! One of these wrenches goes to work at each corner of a railroad car to open the car bottom allowing material to spill out.

• By Daniel A. Keefe

MANY bottom dumping railroad cars supply our plant each day with raw materials. A ratchet mechanism at each corner of the car is operated to open a section of the floor allowing the material to spill out. Turning this ratchet mechanism is now easily done by the air cylinder shown in the drawing. It has not always been so easy—and in many plants it still may be done by a man pulling on the business end of a long lever.

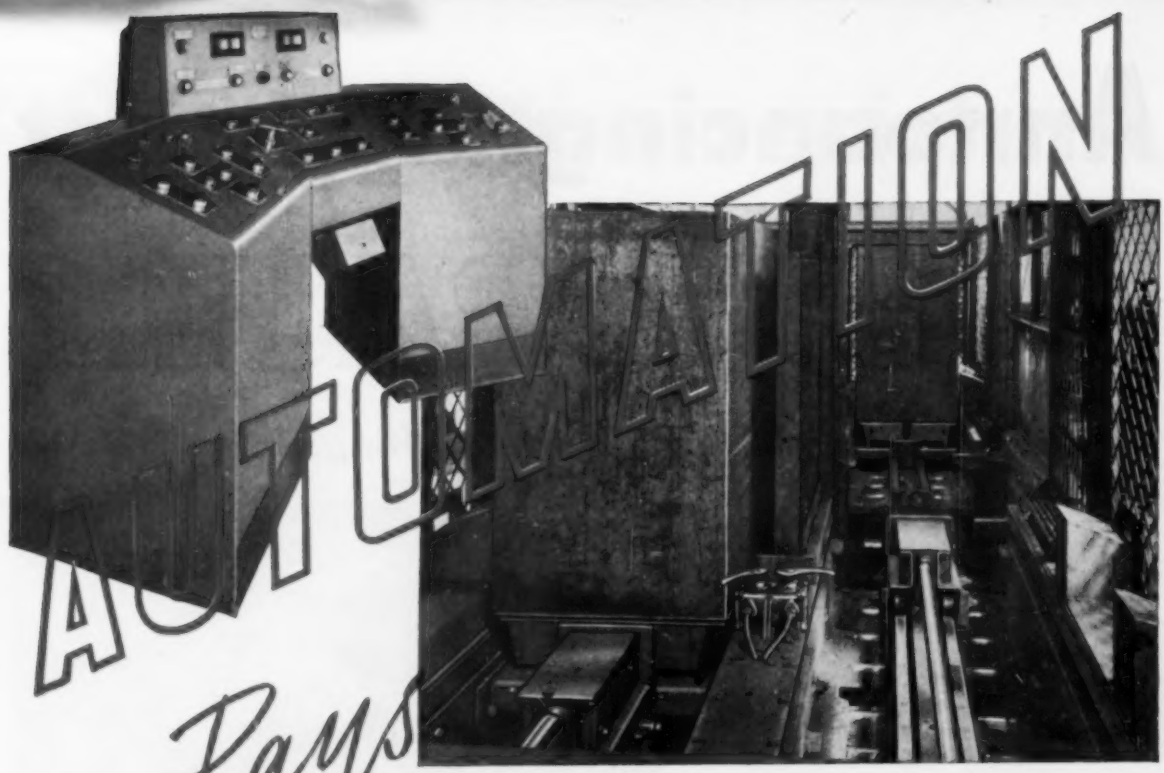
Doing this job manually at each of the four corners is no small chore. Sometimes the ratchet wouldn't budge even with a five foot persuader and a 175 pound man prying with all his strength.

To replace the unsafe manual operation, a number of different methods were studied. The inaccuracies of the ratchets on the cars made a lever wrench impractical and the problems of railroad clearances, initial cost, and maintenance discouraged use of an electric hoist. Of course, there is the car tilting method but this involves a very costly layout. Why not use a pneumatic cylinder to operate each mechanism on the cars?

There's no power problem because plant air supply at 90 psi is close by. To develop and install the air powered system, railroad clearances were considered. The units were made strong enough to do the work, yet not too strong to damage the cars. Foot-pounds leverage obtained by a man pulling up on a five foot bar was calculated and a cylinder that would exert about three times that force with a shorter lever was chosen. A 30 inch stroke was needed to enable moving the ratchet the full distance of one cog, which is usually enough to trip the mechanism on the cars.

The cylinders operating at 90 psi exert a pulling force of 1,200 pounds. This force multiplied by a 2½ foot lever arm gives a total of 3000 foot-pounds leverage. ▼▼▼

DANIEL A. KEEFE, *Engineering Dept., The Dow Chemical Company, Western Division, Pittsburg, California*



Pays

COAL OUTPUT UP OVER 100%!

AT RAWDON

	BEFORE re-organisation	AFTER re-organisation	
MEN ENGAGED IN HANDLING			
ABOVE	66	8	MANPOWER BALANCE UPGRADED TO COAL-FACE WORK
BELOW	48	8	
NUMBER OF TUBS/CONTAINERS	650	6	INCREASED SAFETY WITH LESS MOVING MACHINERY
MAXIMUM TONNAGE PER HOUR	148.5	360	WOUND THROUGH ONE SHAFT INSTEAD OF TWO

THESE OUTSTANDING FIGURES—*reproduced by permission of the National Coal Board — illustrate the economy and efficiency of the Torley Container Automation powered and controlled by Keelavite Hydraulics at Rawdon Colliery in Leicestershire.*

Plan right with

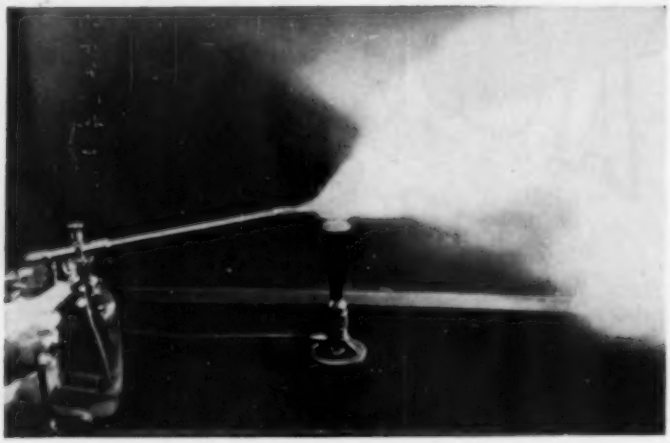
Keelavite *hydraulics*

THE RECOGNISED AUTHORITY ON HYDRAULIC POWER TRANSMISSION

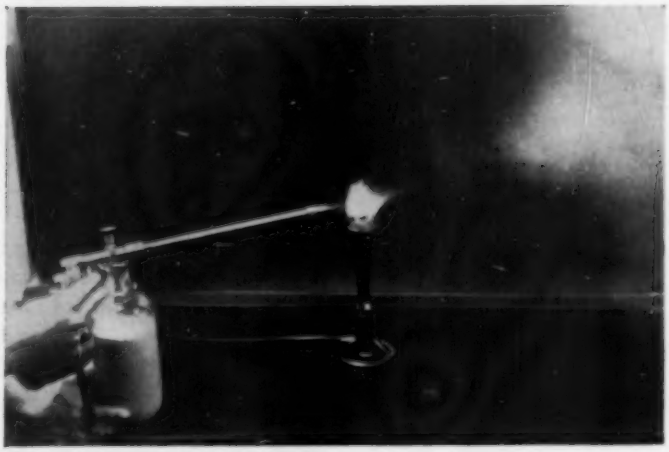
KEELAVITE ROTARY PUMPS & MOTORS LTD., ALLESLEY, COVENTRY, ENGLAND . . . . Telephone: Meriden 411

Announcing...the First HYDRAULIC

Flame tests prove its fire-snuffing ability



This photo shows the instant combustion taking place when a conventional hydraulic oil of mineral oil type is atomized over a Bunsen burner.



In this photo, Shell Irus Fluid 902 replaces the mineral oil. Note that there is no ignition.

SHELL IRUS FLUID 902

Oil-Base fire-resistant FLUID

SHELL IRUS FLUID 902

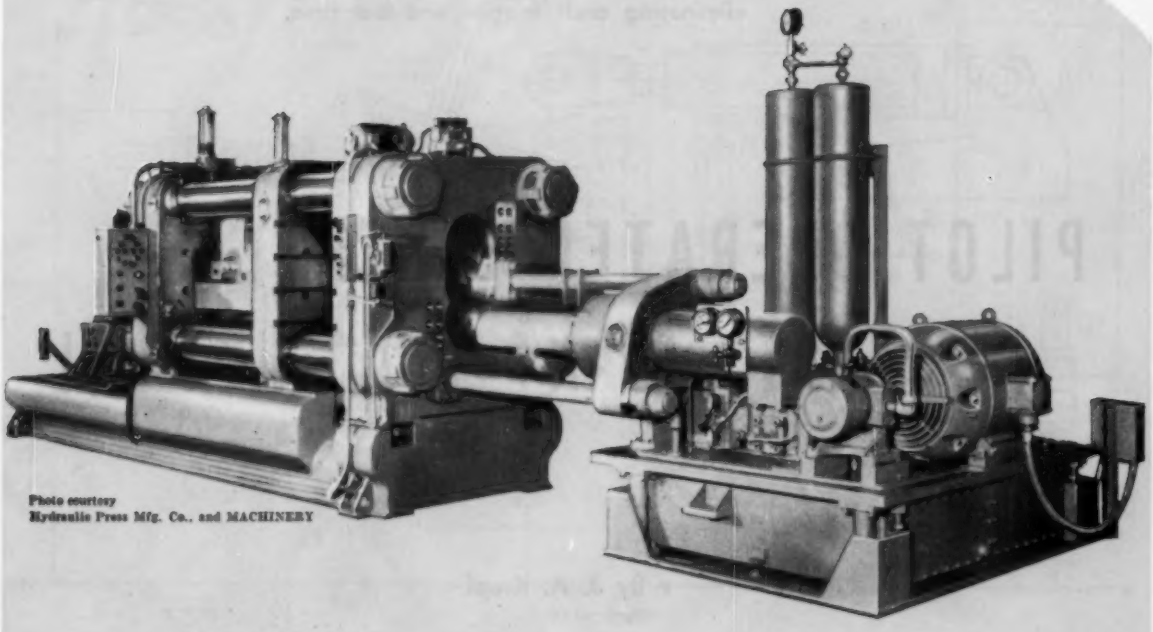


Photo courtesy Hydraulic Press Mfg. Co., and MACHINERY

AFTER THREE YEARS of intensive research, field application and evaluation, Shell Irus Fluid 902 is now commercially available for use in industrial hydraulic systems. While its cost is far lower than other fire-resistant fluids, its performance is comparable.

No major modification of equipment is necessary. Shell Irus Fluid 902 is a special formulation containing no corrosive ingredients . . . no adverse effect on seals or fittings. It is a direct replacement for hydraulic oils now in service.

Noncorrosive, and nonrusting. Steel and copper panels immersed in Irus Fluid 902 for one week at 160°F have shown no significant signs of corrosion. Rusting has not been a problem in long-continued field tests.

This is an efficient fire-snuffing hydraulic fluid that can be widely used. Send coupon for details.

SHELL OIL COMPANY

50 WEST 50 STREET, NEW YORK 20, NEW YORK

100 BUSH STREET, SAN FRANCISCO 6, CALIFORNIA

SHELL

SHELL OIL COMPANY
50 West 50th St. New York 20, N. Y. or 100 Bush St. San Francisco 6, Cal.

Please send me test data and information on Shell Irus Fluid 902.

Name_____

Company_____

Address_____

_____

APPLIED HYDRAULICS

CIRCUIT DESIGN ARTICLE

This pilot operated circuit makes it unnecessary to have a complete electrical circuit to furnish sequence of operation. In plants where one group handles electrical maintenance and another hydraulics, this design puts the responsibility in one group, thereby eliminating craft friction and lost time.

PILOT OPERATED CIRCUIT STARTS GIANT 1500 HP MILL

• By J. A. Krapf

ABOUT 165,000 lb-ft of torque is developed by a hydraulic starter on a cold rolled steel skin mill. The need for this powerful starter developed when it was found that on many occasions when the mill was stopped with a continuous strip in the rolls, the starting torque required to get the mill going again was too much for the 1500 hp electric motor to handle. This meant that the motor had to be reversed far enough so that when run forward it would attain full speed before starting to again roll the strip. The part of the strip which had already been through the mill once had to be cut off and scrapped. Material and time was wasted. Use of the hydraulic starter eliminates this waste.

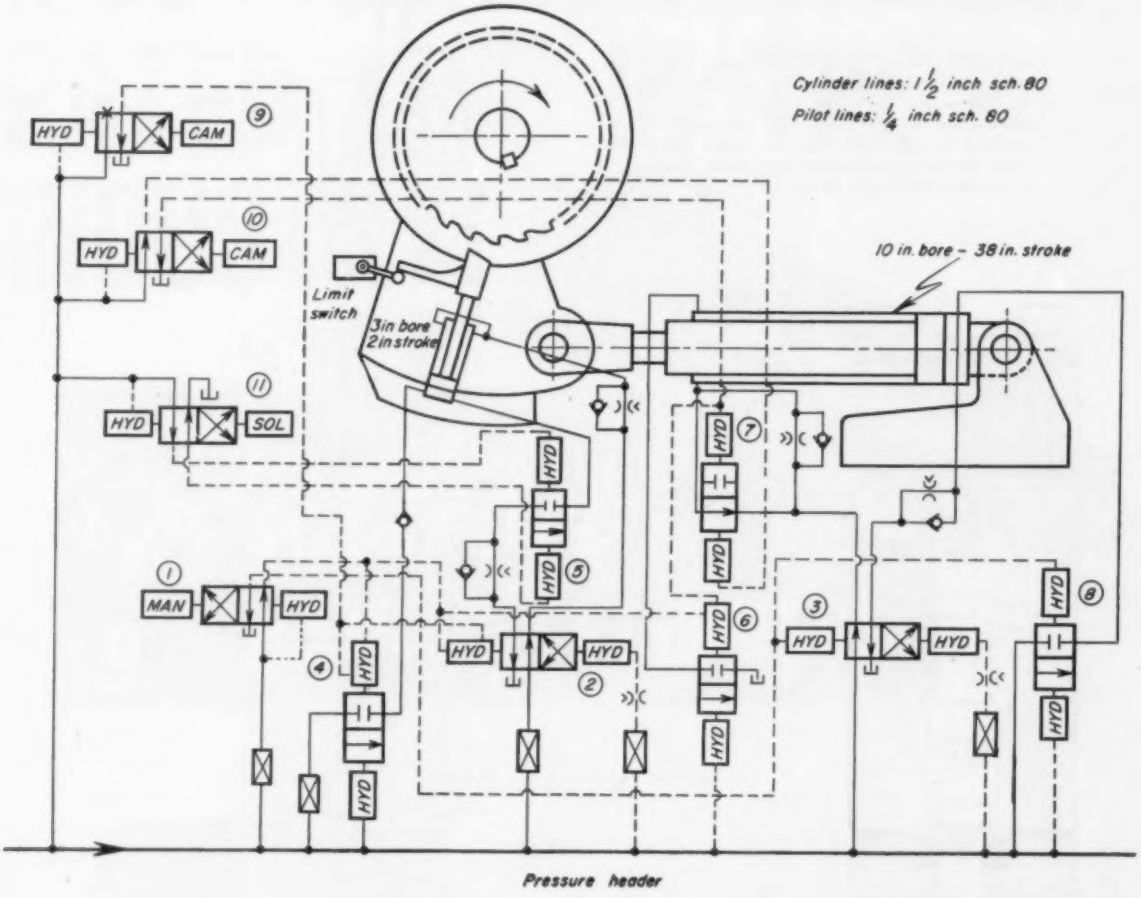
A simple ratchet and pawl mechanism is used. The pawl is engaged and disengaged hydraulically. A 38 inch stroke, clevis mounted cylinder powers the starting action through a rotation of about 90 degrees. Oil at 650 psi is supplied from a weighted accumulator system. Since speed is important and it is also desirable to limit line and valve sizes to 1½ inches, two ports at each end of the power cylinder are used. Doubling of the valves on the cylinder is also a safety precaution. The use of straightway valves gives practically an unrestricted flow between cylinder and headers.

Once the cycle is manually started at valve 1, the remainder of the cycle is sequenced by pilot valves. Cam valves 9 and 10 are tripped near the end of starter action to cause deceleration of motion and removal of the pawl from the ratchet. The limit switch, shown mounted at the pawl, is a safety device to cut off power to the reversing starter to prevent mill reversal if the "reverse" button is depressed when the pawl is in.

The solenoid operated valve 11 is also a safety device. It is electrically interlocked with the mill starter so that the pawl can only be engaged when

---

J. A. KRAPF, *Almar Hydraulic Valve Co., Cleveland, Ohio.* *Special valves in this circuit are covered by patents or patent application.*



ELECTRICAL INTERLOCKING permits operation of this hydraulic starter only when the forward jog button on the mill is held depressed. Mill reversal is not possible when the starter pawl is engaged in the ratchet.

the forward jog button is held depressed. Valve 5 will open only when valve 11 is energized.

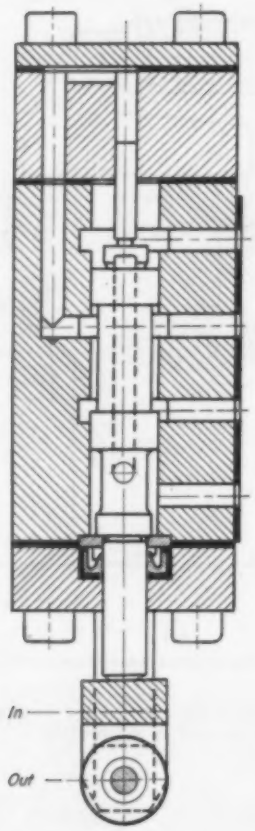
When solenoid valve 11 is energized, movement of valve 1 will start the cycle. Valve 2 is pilot operated to permit flow to the blank end of the pawl cylinder. The pawl is engaged in the ratchet. At the same time, valve 6 opens to permit oil from the rod end upper port of the power cylinder to flow to tank. Valves 3 and 8 shift permitting oil flow to both blank end ports of the power cylinder. Oil from rod end lower port will flow through valve 3 to tank. The motor starter rotates at maximum speed until cam valve 10 is depressed causing pilot pressure to quickly but smoothly close valves 6 and 7. Oil from the power cylinder for the remainder of the stroke is metered through a flow control to provide deceleration. Near the end of the stroke, cam valve 9 is depressed causing pilot pressure to shift valve 2. Oil is now directed to remove the pawl. The electric motor is now running. Valve 1 is released causing reversal of valve 3 and closing of valve 8. The cylinder retracts and as cam valve 9 and 10 are released all valves reset.

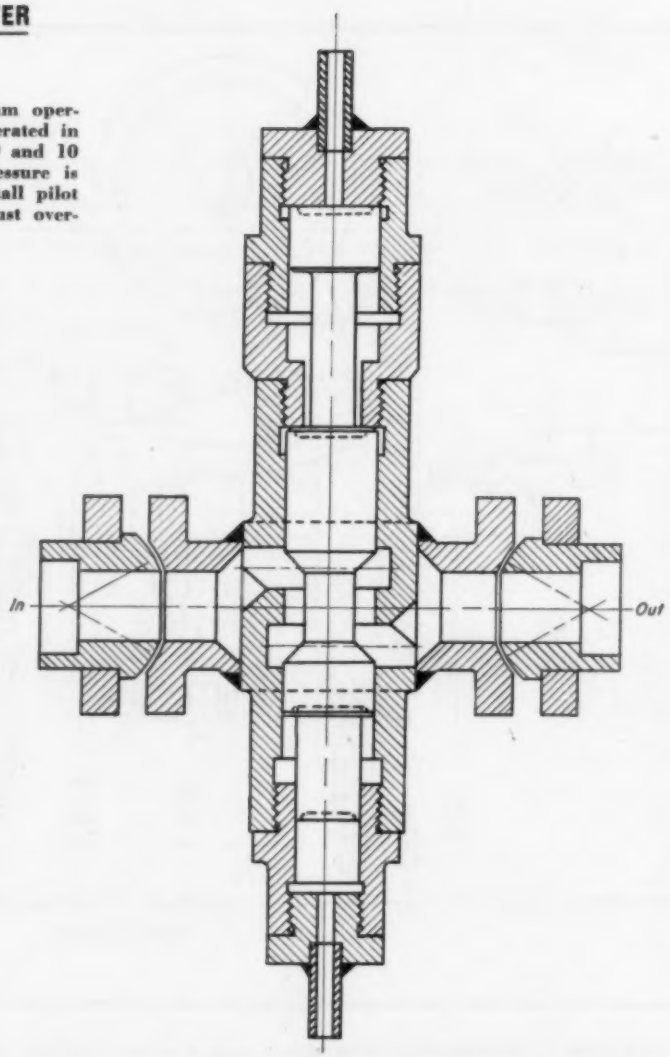
MOTOR STARTS QUICKLY

What's the function of valve 4? It is quite likely that the motor will start before the power cylinder has completed its stroke. If so, rotation will be faster than piston travel of the power cylinder, and the pawl will be forced out of engagement by the cam action of the reverse side of the ratchet teeth. Oil must be dispelled from the blank end of the pawl cylinder. As well as moving back through valve 2, this oil moves through valve 4 which was

PILOT OPERATED MILL STARTER

GASKET MOUNTED valves, cam operated in one direction, pilot operated in the other are used for valves 9 and 10 shown in the circuit. Pilot pressure is exerted at all times on the small pilot end. Force against the cam must overcome the hydraulic force.





DESIGN of this two position straightway valve is typical of all valves used in this 500 hp mill starter circuit. There are no gaskets of threaded connections. Valves 4 and 6, in the circuit, are of this design having three pilot connections.

opened when valve 1 was first actuated. Although valve 4 is connected to the pressure header, the force pushing the pawl back is great enough to overcome line pressure. Of course, once the motor starts, valves 9 and 10 are almost instantaneously depressed. Valve 4 cannot be connected to drain instead of pressure because pressure would then be lost through it when oil is directed to push the pawl in. Also it was decided not to use the check alone, without valve 4, because any leakage past the check might cause undesirable pawl action.

An unusual feature in this circuit is the pilot operated valves. By properly proportioning the areas of the pilot pistons, proper valve actuation is assured when pilot pressure is applied or released. Double pilot action on one end of valve with a constant pressure on other end, as in valves 2, 4 and 6, is also unique. A cross-section of this pilot arrangement illustrates the operation. Use of pilot operated valves eliminates springs and assures positive operation.

Use of ball bearing type swivel fittings permits use of pipe for the fluid lines which move as the starter rotates. ▼▼▼

MOST CONSERVATIVELY RATED LINE IN THE INDUSTRY!

Pathon HYDRAULIC CYLINDERS

and here's why

NOTHING HOLDS LIKE A SCREW THREAD

— and only Pathon offers a full line of Hydraulic Cylinders using a single screw thread to retain the cylinder head. Because this construction offers much greater strength, leakage will not occur at 50% above rated pressure and shock loads or intermittent operation in this range will not damage the cylinder. More compact, too.

Series R.H. 2000 P. S. I. Series Q.H. 1000 P. S. I.

NEW INTERMEDIATE FLANGE MOUNTING

can be located at any point on cylinder. No special mounting brackets required. Also available in 7 other mounting types.

Write or phone for our catalogue.

Pathon MANUFACTURING CO.

The most complete line of Hydraulic Cylinders in the Industry

Ψ could designate P. S. I.

3823 Pacific Avenue Cincinnati 12, Ohio

FIG. 1. Operator's cab, oil powered rake and power unit is suspended from an overhead travelling crane.

OSCILLATING TORQUE MOTOR

. . . *eliminates complicated linkages*

Here's a specially designed machine which solves a safety problem, eliminates hard manual labor, and has all the makings of a good design for a "ride" in an amusement park.

● By B. A. Pearson

WANT to accept a challenge? Could you design a more compact oscillating drive than the one used on the oversize "back scratcher" shown in Figure 1? Suspended between the I-beams of an overhead travelling crane, the machine is a complete self-contained unit. There is the operator's cab, the hydraulic package, and the cylinder powered rake. These elements are all fastened to a 10

B. A. PEARSON, Chief Engineer, Ederer Engineering Company, Seattle, Washington

It's too hot in August to read a long story . . .

BUT HERE'S A MAJOR POINT TO REMEMBER:

More than 125 Bellows Field Engineers, in every major industrial area in the United States and Canada, safeguard you against excessive "down time" — are at your call to service quickly air-operated equipment using Bellows "Controlled-Air-Power" Devices.

For the story how Bellows can help you produce more at less cost write for Bulletins BM-25 and ML-3.

The Bellows Co.
Dept. AH-556
AKRON 9, OHIO

7174-2

OSCILLATING TORQUE MOTOR

inch vertical pipe which is rotated by the simple mechanism shown in Figure 3.

The rotating device is an oil-powered, oscillating torque actuator which can oscillate the entire machine through an arc of 280 degrees. The actuator selected for this design develops 10,000 inch-pounds of torque at a system pressure of 1000 psi. The shaft of the actuator is splined directly to the 10 inch pipe. Size of the actuator is only about 9 inches in diameter and 7 inches high. A nice compact solution to this drive requirement.

What does the big rake do? It is used by one of the country's leading lumber manufacturers to rake stored "hog fuel" to keep it moving onto conveyors which carry the fuel to a power house. "Hog fuel" is mill waste—chips and sawdust—which is used as a fuel source for a power generator station. When this fuel is stored, it packs into a firm mass which will not flow onto the conveyors located below floor level unless it is loosened.

Manual labor using pitch forks and long pointed poles has been the most common method of breaking up the hog fuel. Frequent cave-ins of the hog fuel pile makes this hand method extremely hazardous. And because of this hazard, two men are usually required so each can keep an eye on the other. This hazardous condition led to the development of the oil powered "rake-crane" by the Ederer Engineering Company.

It was decided that the most effective way to keep the equipment off the building floor was to suspend all the operating machinery from an overhead type crane of the double girder type.

FIG. 2. Horizontal and vertical motion of this giant "back scratcher" is powered by long stroke cylinders.

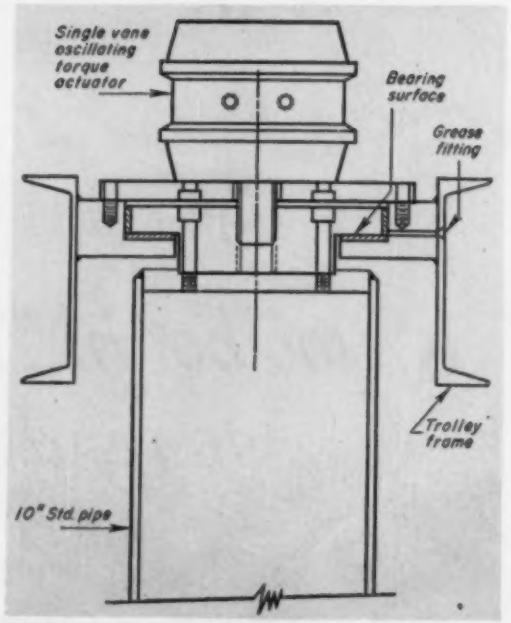


FIG. 3. Rotation of the rake-crane is produced by a single vane torque actuator mounted between the girders of the overhead crane.

For the fuel handling, time was spent investigating the application of a hydraulic back hoe type of ditcher as manufactured by several companies for use on farm type tractors. Because some of the units could not produce the necessary horizontal movement of the bucket along the floor, their use was not considered practical.

HORIZONTAL RAKE MOVEMENT

It was estimated a maximum force of 1500 pounds would be required to pull or push the rake under the most severe working condition. To obtain a fast return stroke and a slower pull stroke on the rake a hydraulic cylinder with a 2 to 1 differential rod was chosen. A 2½ in bore cylinder with 1¾ in diameter rod gives a maximum force of 4900 pounds and minimum force of 2500 pounds when operating at 1000 psi. Control of this cylinder as well as all others is with manual operated 4-way spool type valves which provide good variable speed control. Relief valves limit the force applied to the rake in both the push and pull strokes, and prevent overloading of the crane structure in case the rake should catch on some part of the building or floor conveyor.

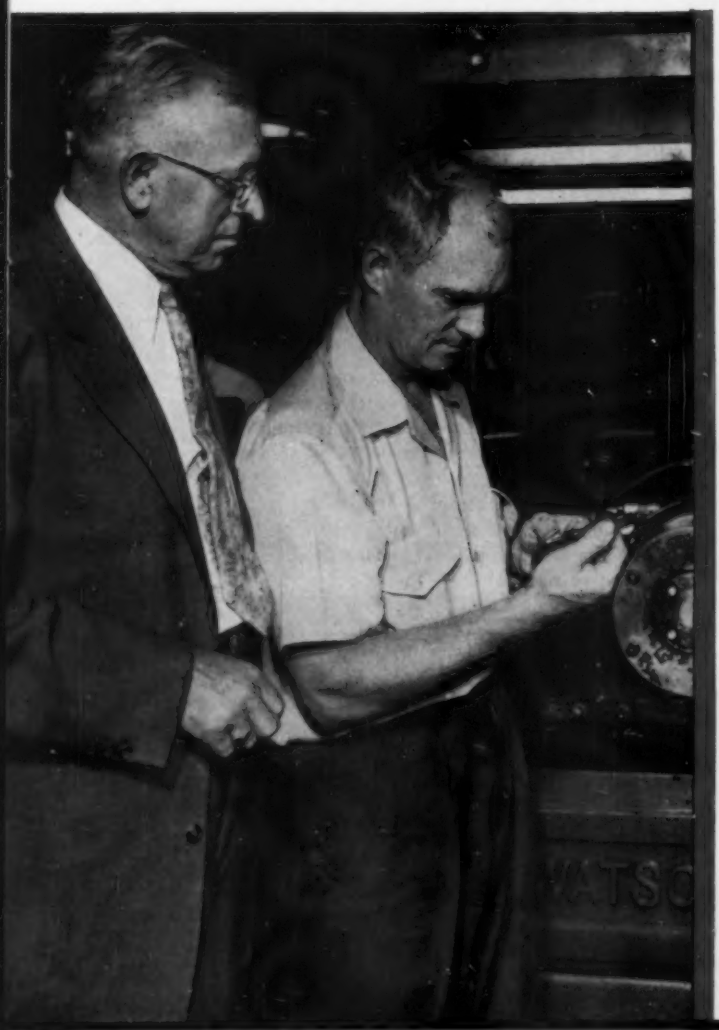
VERTICAL RAKE MOVEMENT

For the vertical movement of the rake boom, a 2½ inch bore hydraulic cylinder is used together with a counterbalance valve in the circuit to give

Concluded on page 78

Circle 93

STANOIL *Industrial Oil delivers on tough assignment at Indianapolis Screw Products Corp.*



Rolling threads on aluminum bronze with pitch diameter tolerances as close as .0014" is a tough job but Indianapolis Screw Products Corporation is used to taking on such jobs and delivering. They give tough jobs to the hydraulic oil they use, too, and they expect it to deliver. They've given such a job to STANOIL and they're getting the results they expect—and more.

STANOIL Industrial Oil is used in the hydraulic system of a Watson-Flagg precision thread roller in the Indianapolis Screw Products Corporation plant. The system uses a Vickers pump and Cuno filter. The filter has not been cleaned in over a year *because it hasn't needed cleaning.* Here, as in other applications, STANOIL delivers top performance with minimum maintenance and maximum system cleanliness of the hydraulic system.

STANOIL likes tough assignments like this one; likes them because it can deliver with plenty to spare. Perhaps you would like to know about the use of STANOIL in a hydraulic application in your plant. In the Midwest and Rocky Mountain states, a lubrication specialist at your nearby Standard Oil office will be happy to discuss it with you. Call him. Or contact Standard Oil Company, 910 South Michigan Avenue, Chicago 80, Illinois.

Mr. R. W. Williams, Plant Superintendent checks pitch diameter of thread with Glenn Riggs, Standard lubrication specialist. Glenn Riggs is an old hand at helping industrial firms work out lubrication problems. Glenn has been doing this sort of thing for 28 of the 30 years he's been with Standard. This background and experience, customers have found, pay off for them.

Cuno filter (left) remains clean after more than year filtering STANOIL. Vickers pump on Watson-Flagg Thread Roll machine (right). Good housekeeping and STANOIL team to give top performance in this hydraulic system.

STANDARD

STANDARD OIL COMPANY

(Indiana)

New Products By

L and L

Only L & L offers the complete line of fittings, with the widest choice of design, for any type of hydraulic piping application.

CN Fittings

- L & L "CN" seals pressure *without* use of O-Ring.
- Savings in tools, scrap and loss of production, also in assembly and maintenance.
- Eliminates stress in valves—elbows and tees can be positioned to 405°.
- Assemble and reassemble without damage to port or fitting—no need for sealing compounds.
- Excellent resistance to vibration.

L & L O-Ring Fitting

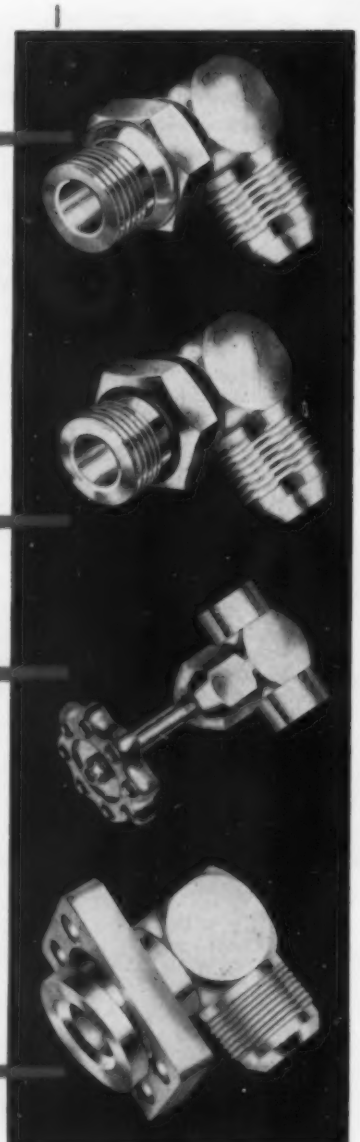
- Seals pressure *with* O-Ring.
- Reduces installation time—no need for sealing compounds.
- Range of sizes from ⅛" to 2".

Metering Valves
Carbon and Stainless Steel

- Pressures up to 5000 PSI.
- Straight or angle valves with male pipe, female pipe or tube connections.
- Use as a metering or shut-off valve.
- Range of sizes from ⅛" to ¾".

Flange Fittings

- S.A.E. bolt hole spacing.
- Solid and swivel tube, pipe or weld connections.
- O-Ring seal.
- Elbows and tees can be positioned.
- Bolt together and use as flange unions.



Representatives in principal cities. Write for full particulars to:

L and L MANUFACTURING COMPANY
8088 E. Nine Mile Rd., Van Dyke, Mich.

Only L & L gives you a "Complete Fitting Line"

OSCILLATING TORQUE MOTOR

Concluded from page 76

positive control when lowering the boom. This cylinder is supplied with oil from the low volume side of a double type pump. To allow independent operation of the horizontal and vertical rake movements the horizontal cylinder was supplied from the high volume side of the pump.

RAKE BOOM ROTATION

Smooth start-stop action of rotating motion is easily controlled by a 4-way valve and pilot operated counterbalance valves with built-in checks. Two of the counterbalance valves, one in each line to the actuator, are used as brake valves. Maximum speed of rotation is regulated by a needle valve which is adjustable to bleed-off some of the oil supply.

Cross-travel of the rake-crane and bridge travel are electrically powered in the same manner as a conventional, overhead travelling crane hoist. Electrical power is fed to the crane by a cable reel and tyrex cable.

Through the use of hydraulic equipment with its infinite speed control the operator quickly learned to run the hog fuel rake-crane to obtain maximum desired results. ▼▼▼

SPIKE PULLER DESIGN

Concluded from page 53

continues upward to complete the pulling stroke at a reduced force.

The reduction in oil requirement made possible by this cylinder design pays off in higher speeds, saves energy stored in the accumulator and reduces heating of the oil due to the rapid action of the pulling cylinder.

A small breather opening and filter are fitted into the top of the cylinder. Some cushioning of shock caused by the piston rod striking the end of the cylinder is provided by a nylon washer. The breather makes possible a rapid return of the piston by providing an escape for the air above the piston. If there should be any oil leakage past the piston "O" rings, it will be discharged out the breather. This external leakage will indicate the need for packing service. This dynamic application of an "O" ring seal proves quite satisfactory in service.

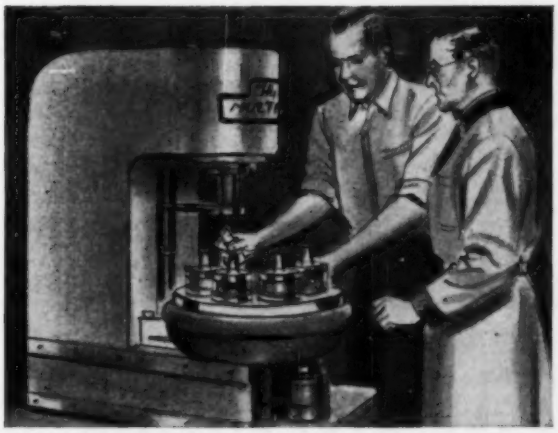
SYSTEM PRESSURE

Since this is a portable unit, size and weight is important. Operating the hydraulic system at 2700 psi keeps the components at a minimum size. An axial piston pump was selected because it generates the desired pressure and gives a good service life. A high pressure micronic filter was added in the pump outlet line as insurance against particles getting into the circuit and fouling or jamming the valves. ▼▼▼

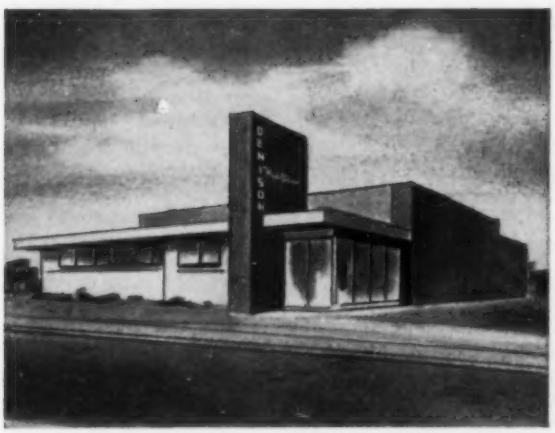
Complete hydraulic service... from one dependable source...

DENISON

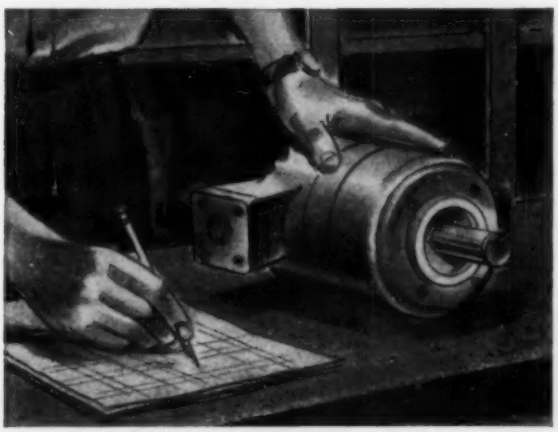
FREE APPLICATION ENGINEERING by experienced hydraulics specialists to improve your circuits.



JOB DEMONSTRATIONS to *prove* how your operations can be made more efficient with the new hydraulic developments.



REGIONAL FACTORY SERVICE includes *complete maintenance facilities* for building, testing, repairing equipment.



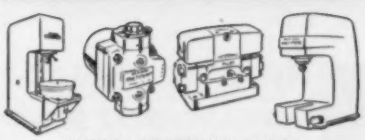
OVER-THE-COUNTER SALES from local stock to give you *immediate delivery* of hydraulic pumps, motors and controls.

Behind the name Denison... With its regional warehouses and branch offices, Denison's factory service is now as near as your telephone. Specialists in hydraulics are immediately available to help you build a better product, build it for lower cost.

Regional Warehouses in Chicago, Houston, Los Angeles, Clark, New Jersey. Branches in every principal city.

THE DENISON ENGINEERING COMPANY
1166 Dublin Road • Columbus 16, Ohio
A Subsidiary of American Brake Shoe Co.

DENISON HydrOILics



HYDRAULIC PRESSES • PUMPS MOTORS • CONTROLS

Aviation Section

hydraulics • pneumatics

EDITORIAL ADVISORY BOARD

WAYNE S. BOALS *Hughes Aircraft Company* • **HAROLD E. WELLS** *Bendix Aviation Corp.* • **H. G. CONWAY** *Short Bros. & Harland, Ltd.* • **RALPH E. MIDDLETON** *Lockheed Aircraft Corp.* • **HOWARD FIELD, JR.** *Consolidated Vultee Aircraft Corp.* • **FRANK MITTELL** *North American Aviation* • **W. F. TALBOT** *Northrop Aircraft, Inc.* • **FRED H. POLLARD** *Republic Aviation Corp.* • **PHILIP MUSA** *Grumman Aircraft Engineering Corp.* • **KENNETH W. DUBOIS** *Douglas Aircraft Company*

SELF-DISPLACING ACCUMULATOR

. . . shortens lines and minimizes pressure losses

Northrop designed self-displacement accumulator easily meets aircraft specifications for lightness and compactness. This unit, having 50 cu in air volume, is the largest available self-displacing accumulator.

• By Scott Hawkins and E. R. Cooper

AS military aircraft increase in size and complexity, demands are made on the hydraulic system to actuate mechanisms in positions far removed from the hydraulic pressure source and its reservoir. Minimum weight, always a major design consideration, limits the size of all components. It has long been an accepted method to use accumulators to supplement a minimum power source and to permit higher flow rates than the normal capacity of a hydraulic pump pressure source.

A hydraulic pressure accumulator is commonly used to provide power and speed, to avoid pressure loss incurred in long lines and to provide sufficient volume for the operation of a hydraulic actuating cylinder. It is best to locate the accumulator and the necessary control valve near the actuating cylinder.

However, the location of the accumulator in close proximity to and as a supplementary pressure source to the actuating cylinder solves only a part

SCOTT HAWKINS, *Design Engineer, Northrop Aircraft, Inc.*; E. R. COOPER *Sales Engineer, Pacific Division, Bendix Aviation Corp.*

PESCO REPORTS ON:

tomorrow's aircraft accessories

In well-equipped laboratories, in busy engineering offices, PESCO's "mind-power" is hard at work perfecting design concepts for tomorrow's aircraft accessories. These will be vital elements of the jet, rocket and nuclear-powered aircraft now being planned to meet the challenge of the Atomic Age.

This is a progress report from PESCO on what the future may hold for aircraft accessories.

ADVANCED DEVELOPMENTS

In development or preliminary design at PESCO are such unique products as pumps for propellants and special fuels—hydrogen peroxide, ethylene oxide, nitric acid, propyl nitrate and others; pumps for circulating liquid metal nuclear coolant; an electro-hydraulic nuclear control rod mechanism; electro-hydraulic servo transfer valves; and air and gas turbine drives.

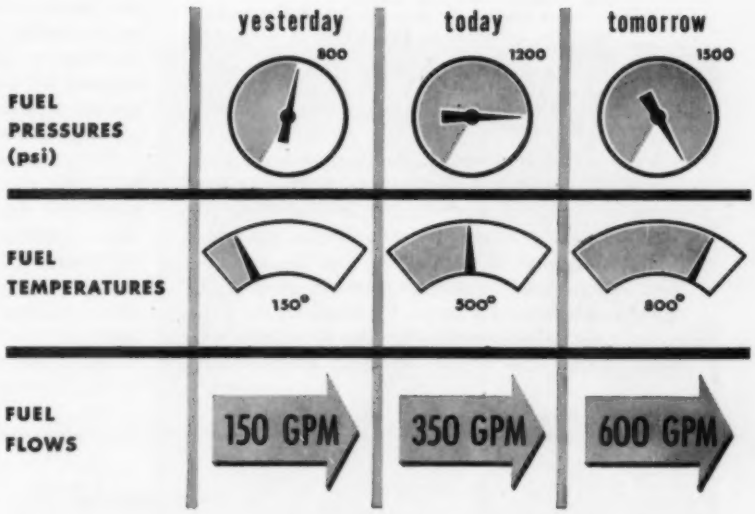
Never content, PESCO engineers have set their sights on some eye-opening performance standards. For aircraft of the future, they foresee fuel pumps that will operate at fuel temperatures of 800° . . . pressures of 1,500 psi . . . and flows to 600 gpm. Propellant pumps will provide capacities to 5,000 gpm, nuclear coolant pumps will handle 15,000 gpm (see illustration).

DEVELOPMENT FACILITIES

Development of tomorrow's aircraft accessories will require extensive physical laboratory facilities . . . and PESCO has planned for this. At present, PESCO has: Hydraulics Laboratory, Fuel Laboratory, Electrical Laboratory and Materials Laboratory. By 1957, PESCO will have added a High Temperature Fuel Laboratory, a High Temperature Hydraulics Laboratory and a Propellant Laboratory. Longer-range plans call for an Advanced Propellant-Nuclear Coolant Laboratory. In addition, PESCO has available the central research facilities of its parent firm, Borg-Warner Corporation.

CURRENT DESIGN PROGRAMS

Active prototype development work is now well-advanced on main engine fuel pumps for almost all major aircraft engines including the most advanced turbojet, turboprop and gas turbine models.



Projected performance characteristics for tomorrow's aircraft fuel pumps.

Equally vital are afterburner pumps for the turbojet engines which require them. Fuel booster pumps are being engineered for many planes and include such recent PESCO advances as line-mounted and plug-in types. Other projects include variable displacement hydraulic pumps and hydraulic motors.

CURRENT PRODUCTION

PESCO is more than a forward-looking development engineering organization—PESCO experience qualifies it as a top source for aircraft accessories. From PESCO production lines, the aircraft industry is now getting jet engine fuel pumps, fuel booster pumps, fuel flow controllers, hydraulic pumps, air and vacuum pumps, axial flow blowers, pilot's pressurization suit air conditioning packages, fuel valves, hydraulic valves and electric motors.

WHERE PESCO CAN HELP

With its engineering skills and technological resources, PESCO stands ready to help you with your new product design problems. If they involve the control or transmission of any pressurized materials, from air to liquid metals, our engineering staff will be glad to discuss them with you.

To develop *tomorrow's aircraft accessories* the alert, far-sighted technical group at PESCO is at the service of industry or government.

For *today's aircraft accessories*, PESCO is your most dependable source. For full information on PESCO services and products, contact your nearest PESCO sales engineer or write: PESCO, 24700 North Miles Road, Bedford, Ohio.

engineering Pesco production

PESCO PRODUCTS DIVISION
BORG-WARNER CORPORATION
24700 NORTH MILES ROAD • BEDFORD, OHIO

Producing the Best in Hydraulic Pumps, Fuel Pumps, Electric Motors and Axial Flow Blowers

Circle 77 on Reader Service Card

of the problem. There still remains the problem of returning the hydraulic fluid from the non-operating side of the cylinder to the reservoir at a high rate of flow. This involves several complicating factors:

1. High pressure loss through a normal size return line reduces the effective operating force on the actuating cylinder;
2. Large return lines, used to minimize the pressure loss result in additional weight;
3. A larger reservoir to accommodate fluid returned from the accumulator, also results in additional weight; and
4. When a separate low pressure air-charged accumulator is used to absorb the return fluid, the operating pressure is decreased and the weight of the system is increased.

A self-displacing hydraulic pressure accumulator, developed by a leading manufacturer to the requirements of Northrop Aircraft, Inc., solved many of these inherent problems by providing a reservoir chamber designed in such a way that its displacement volume mechanically increases in proportion to the accumulator discharge. By mounting the unit close to the actuating cylinder, the fluid from the non-operating side of the actuating cylinder can be absorbed in the reservoir chamber of the accumulator with a minimum of pressure loss. Later, as the accumulator is being recharged, this fluid can be returned from the reservoir chamber to the system reservoir at the normal rate of flow of the system pressure pump.

The self-displacing hydraulic pressure accumulator is actually a reservoir cylinder and an accumulator pressure cylinder mounted in a single body and separated by an aluminum alloy gland which contains a port into each cylinder. Figure 1 shows the main features of design and diagrammatic sketches of the accumulator charging and discharging. A sliding piston in each cylinder provides four chambers of variable size. The pistons are fastened together by a rod; each of the chambers is sealed against leakage or transfer of fluid by "O" ring packings and teflon backup rings.

The accumulator pressure cylinder operates as a hydraulic pressure accumulator with one chamber containing the compressible air precharge and the other chamber containing the hydraulic fluid at the system pressure. In the reservoir cylinder, one chamber acts as a hydraulic fluid reservoir and the other chamber is open to air at atmospheric pressure.

The operation of the accumulator charging and

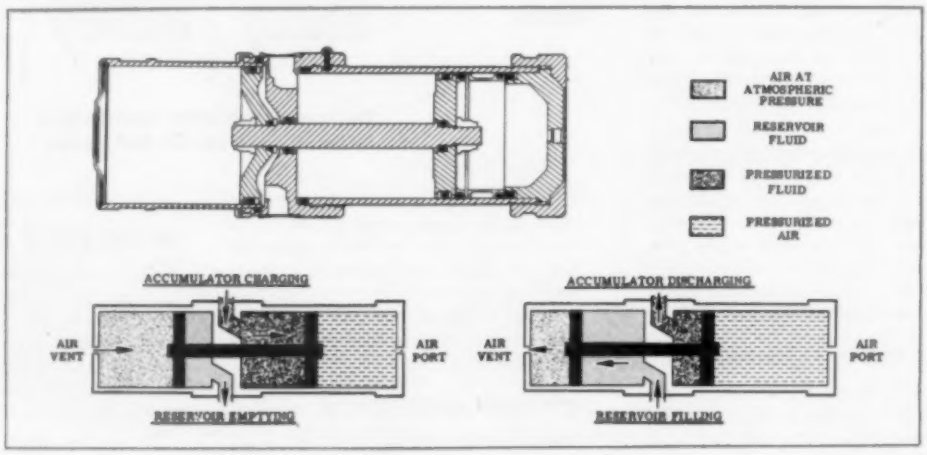


Fig. 1. How the self-displacement hydraulic pressure accumulator is made and how it works: Above, the sketch clearly shows the two cylinder heads tied together and the aluminum alloy gland. Below, left, shows position of cylinder during accumulator charging; right, position of cylinder during accumulator discharging. The volume of hydraulic fluid in the reservoir chamber decreases as the volume of fluid in the accumulator pressure chamber increases or vice versa.

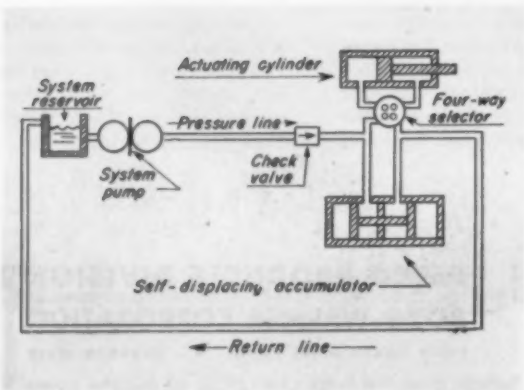


Fig. 2. Schematic sketch of a typical application, showing a self-displacing accumulator installed close to a remote hydraulic actuating cylinder.

discharging strokes can be followed by the cross sectional sketches in Figure 1. In general, the volume of hydraulic fluid stored in the reservoir chamber is decreased as the volume of fluid in the accumulator pressure chamber is increased and vice versa. At the left, Figure 1, is illustrated the accumulator charging stroke. The reservoir cylinder is emptying, the air side is open to atmosphere, the other side acts as a fluid reservoir. On the accumulator discharging stroke air and fluid flow is reversed. As the reservoir fills, fluid under system pressure is discharged.

The ratio of accumulator pressure volume to reservoir capacity may be varied to accommodate the differential flow rates incurred with some large piston rod actuating cylinders with unbalanced areas by increasing or decreasing the diameter of the reservoir piston. If it is undesirable to increase the size of the reservoir chamber, a reasonable amount of return flow can be tolerated with no loss of useful force resulting from back pressure.

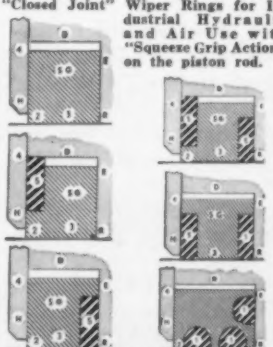
This ability to tolerate return flow without back pressure loss is peculiar to the design of the self-displacing hydraulic pressure accumulator. The return line pressure acts against the resevoir chamber piston which is connected to the accumulator piston. The accumulator piston, in turn, transfers the force against the oil pressure volume. In this way, the return line back pressure acts as a booster, effectively nullifying the loss of force otherwise imposed by back pressure by increasing the accumulator actuation pressure. ▼▼▼

Stop This Dirt Streak at the Ring Joint

with the "CJ" Closed Joint

Fall Wiper Ring

Showing 6 of the many FALL "Closed Joint" Wiper Rings for Industrial Hydraulic and Air Use with "Squeeze Grip Action" on the piston rod.



RING DESCRIPTION
SG—Indicates "Squeeze Grip."
2—Front side of ring.
3—Closed joint is in ring.
4—Flange (or plate) holds ring in cavity.
5—Rubber seal compressed in restricted area.
H—Inside dia. of flange at bevel end (see #4 above).
D—Depth of Cavity for holding ring.
E—I.D. of cavity for holding ring.
R—Ring I.D. and/or rod O.D.

FALL Industrial Wiper Rings have a "closed joint" therefore contact entire rod O.D. and remove ice, dirt and other stubborn substances adhering to rod. When needed, certain of our "rubber seal" features are added to ring to "seal out" dust, sand, etc., preventing passage AROUND ring. To "seal out" liquids we add still another rubber seal feature preventing passage THROUGH ring.

SPRING LOADED

Squeeze Grip Action Does It

—and squeeze grip is always the same because of uniform tension of spring on ring at all times.

Our engineers will gladly work with you on any wiper ring problem. Write, wire or phone us.

Ace Products Company, Toledo 1, Ohio
Phone Cherry 36513

You can depend on ACE PRODUCTS . . Estab. 1935!

ALL FALL Wiper Rings are covered by patents issued or patents pending

for Military Standard

TEFLON® SPIRAL BACK-UP RINGS

specify FLUOROFLEX®-T because . . .

- These rings are produced to military standard drawings MS 28782 and MS 28783 under exacting inspection controls.
- Both tube stock and machined rings are individually annealed to relieve internal strains and to assure compliance with aircraft dimensional stability requirements.
- This quality controlled method of manufacture provides rings with *all* properties *certified** to AMS 3651 specification.
- Rings are packed in protective telescopic containers on supporting mandrels to preserve shape and dimensions to facilitate installation.

Complete range of sizes for use with AN 6227, AN 6230 or MS 28784 "O" rings. Send for data.

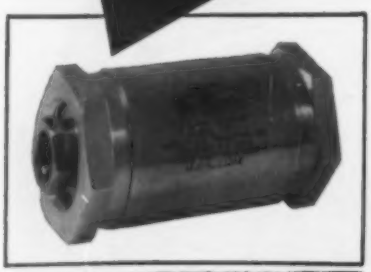
**Photostatic copies of test reports are available upon request.*

®DuPont trade mark for its tetrafluoroethylene resin.
®Resistoflex trade mark for products from fluorocarbon resins.

RESISTOFLEX
CORPORATION

ROSELAND, N. J. • WESTERN PLANT: BURBANK, CALIF.

KEEP AIRCRAFT HYDRAULIC CIRCUITS CLEAN



FERROFILTER

Magnetic Separators

protect fluid power systems of aircraft by removing microscopic ferrous particles that can jam delicate hydraulic equipment. Dry weight only 3 lbs.; 3000 psi working pressure; tapped for ½" tube connection—AND-10050.

When a somewhat higher pressure drop is permissible, Frantz FERROFILTERS may incorporate optionally new, close-wound grids. When assembled and magnetized by the two Alnico permanent magnets, the grids split the fluid stream into much finer elements and greatly increase the efficiency of the FERROFILTER for particles in the low micron sizes.

Send for Bulletin 65-A

High pressure industrial models also available.

S. G. FRANTZ CO., Inc.

Brunswick Pike and Kline Ave.
P. O. Box 1138 Trenton 6, N. J.

Ideas from a Sales Engineer

Elmer F. Heiser

Elmer Heiser has been selling air and hydraulic components for 19 years. During this time he has solved many problems and admits to leaving some unsolved. He is the author of the book "Air and Oil Cylinders in Industrial Applications."

A long time ago, or so it seems, when the ridiculous notion for a series of columns originated, part of the initial effort revolved around the selection of a proper title. As you can see, it is titled "Ideas from a Sales Engineer". That's a compromise and is more or less open to question. The fact that you may never have seen what you call ideas expressed proves the point. An idea to one person may be just so much drivel to another. Even some of my best ideas get pooh-poohed.

So there was some risk attached to writing under the chosen title. After the "Idea" bit, it goes on to say "from a Sales Engineer". In some places that part of the title is not even open to question. Originally I wanted the thing to read: "A Peddler Peers at Fluid Power Problems". That's a safe one. Who would argue with a peddler and further who could quarrel with a guy for just peering out loud. That way if the supposed ideas turned to drivel, so what! But if a jewel should appear it could be a pleasant surprise. Anyway the safe title got lost in the compromises.

The word peddler is defined thus in the dictionary "to travel about with wares for sale". I softened and accepted the compromise due to the next definition. Peddling, instead of being defined as selling comes out "piddling —to be busy about trifles". It seemed logical to agree that peddling (or piddling) as defined by Webster was hardly in keeping with the decor of this magazine.

The above is history but now an opportunity opens to follow through in a reasonably dignified manner on the first idea.

"A Peddler Peers at Piddlin' Problems"

Hereafter, the word piddling is according to common usage, leaving Webster to his own stuffy definitions. It is much easier to say that a very small flow of oil is a piddling flow than to be technically accurate and state its rate in cubic inches per minute. Over the years we've fallen into the habit of so describing low flow rates.

It frequently happens that it is desirable or necessary to restrict hydraulic flow to a minimum to obtain required control. Fine metered flow may be necessary for a number of reasons. We usually think of low flow rates for controlling cylinder movement for tool feeds, but that is only a small part of the picture. "Piddling" rates are often required to limit the speed of valve shifting to reduce shock or obtain a time lag. In fact it is handy many times to bleed a small controlled flow into, out of, or around some element in a system.

The simple, most universal device for restricting flow is the pointed needle type valve. It makes up the adjustable orifice in standard needle type valves built into many hydraulic units, including cylinders (for cushion control), speed control valves, retarding controls for valve shifting, etc.

We have learned from experience, sometimes embarrassing,

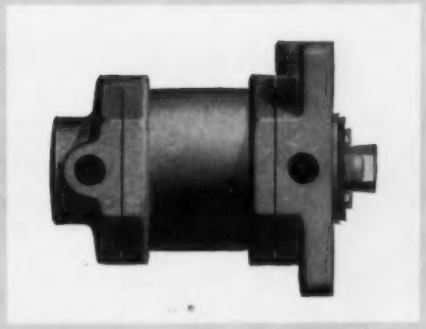
Continued on page 86

Why choose a Rivett Hydraulic Cylinder?

Quick Delivery?

YES!

If you're in a tight spot and need standard models, Rivett can ship in two days.



Low Price?

YES!

You'll make the best deal with Rivett. Large volume production makes prices competitive!

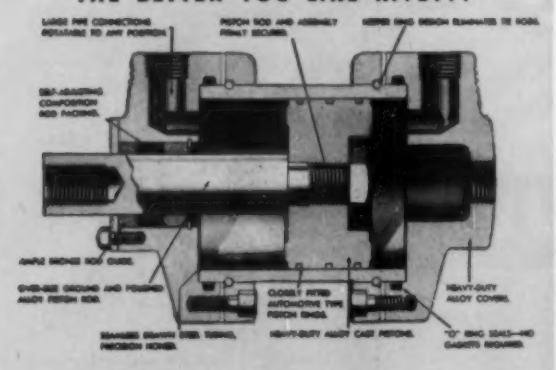
High Quality?

YES!

This is the most important reason for choosing Rivett! After a cylinder is installed, delivery and price are soon forgotten—but not the cylinder's productivity! It is then that a poor cylinder reveals its really high cost. For its faulty construction can result in operational failure—with a breakdown in production.

Better—far better, to buy the quality cylinder; gain the advantages of delivery and price; and enjoy uninterrupted production as well!

THE BETTER YOU KNOW HYDRAULICS, THE BETTER YOU LIKE RIVETT!



Get This Data-Filled Catalog →

Working drawings, cut-aways, tables, diagrams, forces, specifications—all are presented in an easy-to-use style. Write today for free copy of Catalog No. 106.

RIVETT LATHE & GRINDER, Inc.
Dept. AH-8, Brighton 35, Boston, Mass.

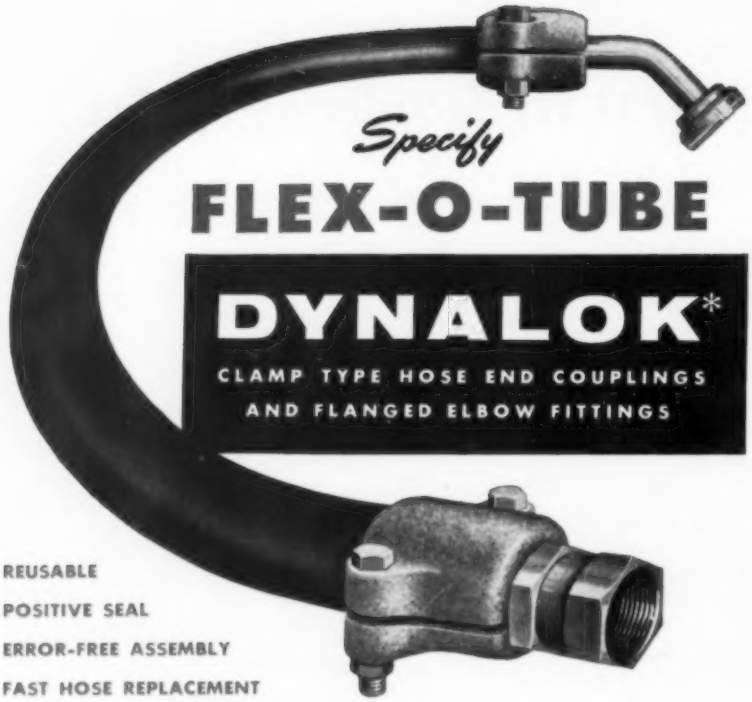
Representatives In All Principal Cities

Member—National Fluid Power Association

RIVETT

furnishes a complete power package

AIR AND HYDRAULIC — VALVES, CYLINDERS, POWER UNITS



Specify

FLEX-O-TUBE

DYNALOK*

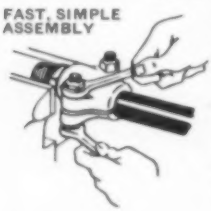
CLAMP TYPE HOSE END COUPLINGS
AND FLANGED ELBOW FITTINGS

- REUSABLE
- POSITIVE SEAL
- ERROR-FREE ASSEMBLY
- FAST HOSE REPLACEMENT
- MAXIMUM HOLDING POWER

Here's a complete line of heavy duty hydraulic fittings for every need! They speed assembly and simplify service, both as original equipment and for replacement, on such applications as automotive, machine tools, marine, farm implements, mining, materials handling, construction and road machinery, lubrication equipment, railroads, fuel transfer lines and petroleum processing.

Both the clamp-type coupling and the flanged elbow fittings are easily assembled without special tools. The clamp type end couplings make it possible to replace hose without removing the fittings from a machine, and are available in a wide range of styles and sizes for hose from ¼" to 2". The flanged elbow fittings are especially useful for mounting in cramped quarters where screw-type connections cannot be used. They offer a positive seal with an O-ring instead of with pipe thread, eliminate one or more seal points, and are quickly installed and removed when necessary. Available for hose from ½" to 2" in six different elbow bends and straight type.

FAST, SIMPLE ASSEMBLY



Ask your hydraulic distributor, or write direct for complete information on Flex-O-Tube DYNALOK Clamp Type Hose End Couplings and Flanged Elbow Fittings, engineered, manufactured and backed by Flex-O-Tube . . . hose couplings specialists for more than 25 years.

*REGISTERED PAT. PENDING

OTHER PRODUCTS

TEFLON HOSE AND HOSE ASSEMBLIES FOR HIGH TEMPERATURE USE

AUTOMOTIVE—Fuel, Oil, Filter, Brake and Window Lift Lines, Air Conditioning and Power Steering Hose Assemblies

AIRCRAFT—Low, Medium and High Pressure Hose Assemblies, Bulk Hose and Reusable Hose Fittings, Oxygen Hose Assemblies

INDUSTRIAL—Complete line of crimped and reusable fittings and hose assemblies for low, medium and high pressure uses

FITTINGS—SAE 37° and 45° Flare, SAE Inverted, Flareless, SAE Bulkhead, Adapter Unions, Push-on, "AF" Hose End, Tube Connectors

SPECIAL FITTINGS—Custom made per your design or developed for your special applications

Division of MERIDAN CORP.

FLEX-O-TUBE

REGISTERED TRADE MARK

2527 JIM DALY ROAD • INKSTER, MICHIGAN

(BRANCH) 10711 CHANDLER BLVD., NORTH HOLLYWOOD, CALIFORNIA

(CANADA) FLEX-O-TUBE COMPANY., LTD., WINDSOR, ONTARIO, CANADA

DISTRIBUTORS IN PRINCIPAL CITIES

Ideas From a Sales Engineer

Continued

that there is a minimum practical flow rate which can be obtained with a cone point needle. As the cone or point of the needle enters the seat opening, the area through which oil must flow is an annular orifice. The further the cone enters the seat section the "finer" the annular region becomes. Even a small needle will close down to a whisker crack to regulate a piddling flow. Of course the diameter of the needle and the seat have a bearing on the "clearance" or crack through the valve to obtain a given flow with a given pressure drop. The larger the needle the "tighter" the annular crack through which the oil must flow.

As mentioned, we have long known that needle valve metering has limits. So often, just about the time you crank the needle down to a point where the piddle is about right it stops flowing. It does not stop abruptly but just sorta fizzles out. You then unwind the needle a couple of turns, opening it too wide and then try to sneak back down to another correct setting. Again when everything seems to be about right, flow changes, diminishing sometimes to zero.

We have logically (to us) suspected the annular orifice as the culprit in this flow fade and for our own rule of thumb purposes have arbitrarily set some minimum practical limits for needle valve flow. These range from fifteen to fifty cubic inches per minute with rough recognition of pressure drop, needle size and oil condition. Most of the time we come out alright but sometimes we find that we need approximately twenty cubic inches per minute but can't get below forty or fifty with assurance of a maintained or repeatable condition. Whether the oil is clean, as with conventional filters, seems to make little difference. Maybe some hydraulic oils have lumpy molecules which stick crosswise in the slit left for oil passage.

How to Get Flows Under 20 cipm

In order to answer some of the problems, we make up restrictors

of small diameter tubing. We use approximately three or four feet of tubing with a .058 inside diameter, winding it on a post provided with one quarter inch pipe connections. We've found these so handy for dampening, bleeding or controlling, that we have them made up in lots of twenty or so and keep them around for piddling purposes. The .058 diameter hole in the tubing does not plug readily and control is obtained due to the resistance to flow over the relatively long orifice length.

Another way around the annular orifice limit is a small lapped fit straight needle with a vee notch along the stem. A fine pitch thread allows for non-critical adjustment and the triangular shaped orifice stays clear, maintaining flow at lower rates than the standard cone point needle. Someday, somebody should make an inexpensive valve of this type; they cost too much to make one or two at a time.

From the above it can be seen that we may have had some reason to reach our conclusions regarding the minimum practical flow limits possible with needle type valves. Now if you are convinced, as we have been for years, that a ground point needle with its annular orifice is not a good piddling valve, be prepared to learn that we could both be wrong.

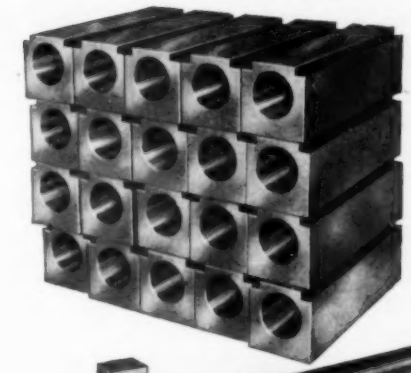
Now Let's Do It With A Needle Valve

Only last week we lost two-bits betting that a flow of 2.5 cubic inches per minute with a 1000 psi pressure drop could neither be obtained or maintained with a standard $\frac{3}{8}$-inch needle valve. After all the contrary experience, how do you like them apples? It happened like that right before our eyes. There was the little old needle valve piddling a trickly stream into a beaker. Falling about fifteen inches the trickle was breaking into drops and a gauge ahead of the needle was hanging smack on the 1000 psi mark and it was not only obtained but maintained for an indefinite period of time.

It was hardly a fair bet though as there was a difference between the hydraulic equipment used and what we usually tangle with. You

Continued on next page

Circle 9 on Reader Service Card



Hydraulic CYLINDERS to specification

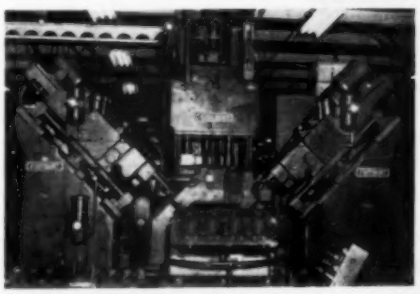
AT your service — since 1918 — the most modern machine tools to handle up to 15" I. D., including the last word in honing equipment and the most accurate of precision gauging equipment. Everything we do is to specification. Expanded facilities permit prompt delivery of 1 or 1000 pieces in any material desired.

Call Erie 2-3664 - Send specifications to

AMERICAN HOLLOW BORING COMPANY

1954 Raspberry St., Erie, Pa.

INTERNATIONAL HARVESTER USES Briggs HYDRAULIC OIL FILTERS ON THEIR NEW MACHINE TOOLS TO PRODUCE THE NEW V-8 ENGINES



3-way FOOTBURT drilling machine performing miscellaneous drilling on cylinder block. One of the many Briggs equipped machines in the Indianapolis, Indiana plant.

When there's a job to be done big producers depend upon the name that spells dependability.

For over a quarter of a century Briggs has given service that makes the best dollar for dollar buy in the field. We would be glad to show you why.

WRITE FOR YOUR COPY OF THE LATEST BOOKLET ON THE OPERATION OF VARIOUS HYDRAULIC SYSTEMS.

THE BRIGGS FILTRATION CO. River Road, Dept. 117, Wash. 16, D. C.

Without cost or obligation send me your latest booklet "HYDRAULICS".

Name .....

Company .....

Address .....

see, we made a visit to Simplex Engineering Company at Zanesville, Ohio to see the recently developed variable volume piston pump. The pump itself and its performance was most interesting. It is a low-cost unit which delivers up to five gpm at pressures to 2000 psi. Variable volume is obtained by admitting a slight back pressure to the pump case to overcome the springs which return the pistons and hold them against the driving eccentric. If the pistons cannot make a full stroke, the pump discharge is obviously reduced. There are six pistons which are "tapped" by an eccentric rotating at 1800 rpm so that oil is discharged by approximately 11,000 tiny pulses per minute.

The pump and its performance is interesting* but this is a piddling story so back to the subject. Why wouldn't it be a safe bet to place a mere quarter of a dollar against the possibility of controlling a flow of 2.5 cubic inches per minute through a 3/8" needle valve. As any fool knows, you just can't take oil at 1000 psi and drop it to zero pressure through a relatively large annular orifice and maintain such a piddling trickle. Right? Think of the many times we've tried to get below 10, 15 or even 25 cubic inches per minute with only 200 or 300 psi drop. Think of the minute hair-line crack around that big needle point and all the fuzz, lint, crumbs, or even lumpy molecules which have to squeeze through the opening.

Could be the Altitude?

Why did ordinary oil, filtered in an ordinary manner, flow continuously in a well behaved fashion in Zanesville when it doesn't do so well in other parts of the country. We think the answer lies in the pulsing flow from the new pump. The jolts or pulsations are not apparent to the observer but it must be that those 11,000 tiny wallops on the oil column each minute allow it to sneak through the split whisker crack in a needle valve. If that is so, some interesting possibilities may be opened. Why for example couldn't the same wave pattern assist in breaking cylinder friction.

Maybe fine feeds for tools can be handled with much smaller cylinders and controls than we accepted previously if the dither flow can perform such tricks. That's it, and come to think of it the revelation came at no expense. Seems that on that bet it was sorta forgotten in the confusion. One of these days I may have a chance to prove the point independently away from any possible hidden trickery, and if it works away from Zanesville, I'll just send the two bits (without interest of course). ▼▼▼

** Next month, a design article authored by Robert E. Raymond of Simplex will analyze this technique of variable pump displacement by pulse generation.*

Control Gases to 10,000 P.S.I.

WITH VICTOR GAS-O-DOME REGULATORS

VICTOR'S LONG EXPERIENCE IN PIONEERING HIGH PRESSURE GAS REGULATION *is yours for the asking. For details, and complete data on Gas-O-Dome Regulators, see your VICTOR dealer or write us for catalog 341. Dealer inquiries invited.*

VICTOR EQUIPMENT COMPANY

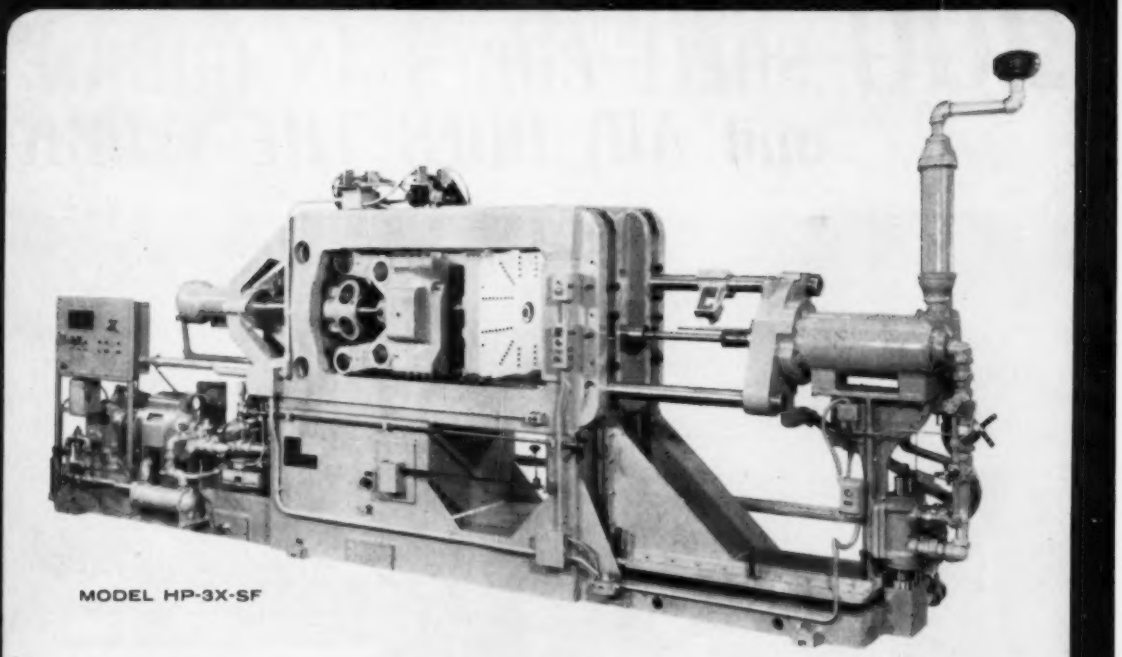
Mfrs. of welding & cutting equipment, hardfacing rods; blasting nozzles; cobalt & tungsten castings.

844 FOLSOM ST. • SAN FRANCISCO 7 21

Gas pressure, not springs, control diaphragm motion to give you precise regulation of high-pressure gases at high or low flow rates. Can be remotely controlled if desired. Safety valve furnished on request. More than 55 stock models in the following series:

GAS-O-DOME SERIES	DELIVERY RANGE (p.s.i.)	SPECIAL FEATURES	GASES HANDLED
GD 30	0-2500	High Delivery Flow Rates. Accurate Valve Control.	Air, Argon, Helium, Hydrogen, Nitrogen, Oxygen —and others non-corrosive to bronze and stainless steel.
GD 31	0-3600		
GD 61B	0-2500	Excellent Capacity. Compact— 7 lb.— 4" x 6" x 6". —67° to +160° F. Range.	
GD 62B	0-3600		
GD 80	0-5000	Accurate Valve Control. —67° to +160° F. Range.	
GD 81	0-10000		
GD 10	0-500	Self-Relieving Pilot Regulator Control. High Flow Rates.	
SR 10	0-1000	High Pressure, Low Flow. Compact—4 lb. —2" x 6" x 6".	
SR 100	0-30 & 0-40	Corrosion Resistant.	Ammonia (wet or dry) Boron Trifluoride Chlorine (wet or dry) Hydrogen Sulfide, Hydrogen Chloride, Sulfur Dioxide—and other corrosive gases.

PYDRAUL...PERFORMANCE-PROVED IN LESTER DIE-CASTING MACHINES



MODEL HP-3X-SF

FOR SOLID MACHINABLE, FULL-MEASURE CASTINGS in aluminum, magnesium, brass, zinc, tin and lead, manufacturers in 21 countries rely on Lester die-casting machines—and have for 21 years! Lesters are built with diemaker accuracy to provide more good castings per shift, reduced maintenance and down time, less need for skilled operators. In addition, Lester machines offer 41 modern features, are fit like a machine tool for tight, even shutoff and are backed by a thorough service program to give you best possible performance.

A tested combination: fire-resistant Pydraul fluid for safe, economical operation of Lester machines

Pydraul was developed to provide industry with a fire-resistant hydraulic fluid which combines safety with superior lubricity. It has a record of proved reliability in Lester die-casting machines, protects plants and personnel *permanently* against hydraulic fluid fires.

Pydraul saves money on fluid consumption, too! It is a better lubricant than petroleum oil, has a longer service life than most other fluids and is reclaimable. You can return spillage to the system . . . use it again and again.

Are You Taking an Unnecessary Fire Risk by using flammable fluid in machines near hot metal, electrical contacts, open flame or other heat sources? A change to fire-resistant Pydraul can save you from a staggering fire loss. Talk to your Monsanto representative. He'll be happy to show you how you can have *positive* hydraulic fluid safety . . . at low yearly cost.

Pydraul: Reg. U. S. Pat. Off.

PYDRAUL MEANS:

Fire Resistance
Excellent Lubricity
High Stability
No Corrosion
Re-Use . . . Again and Again

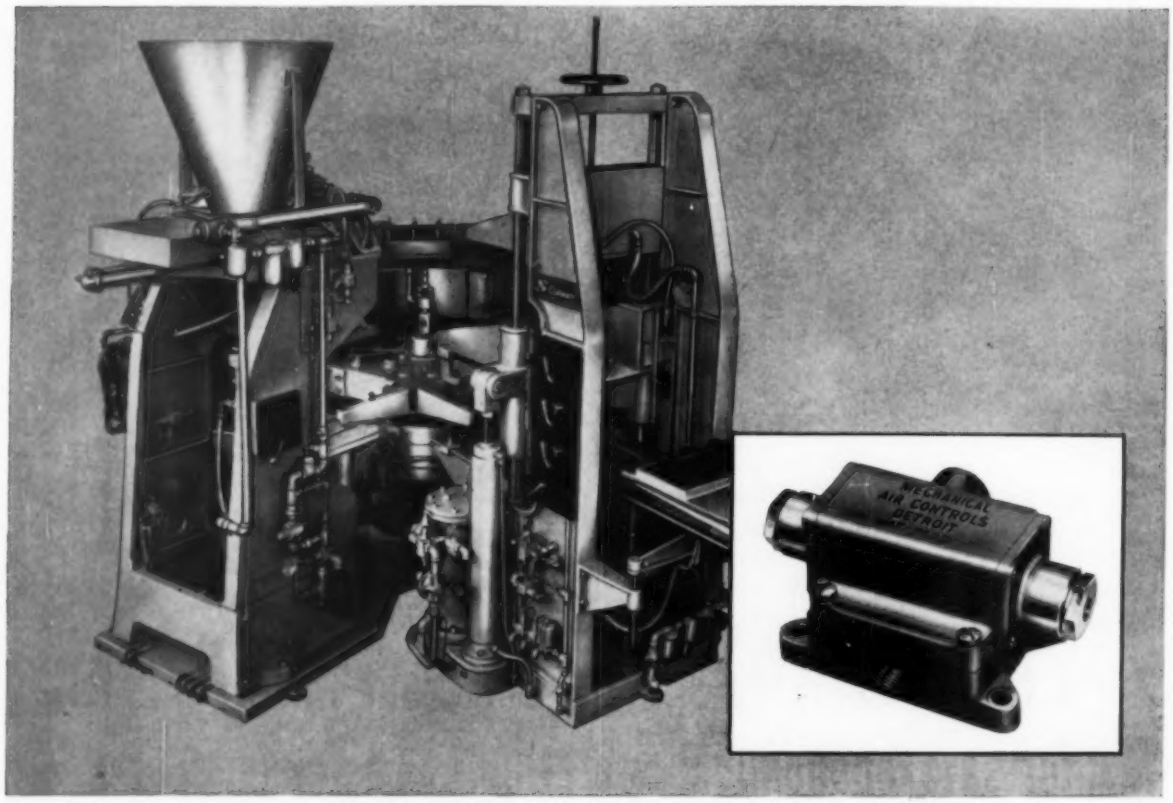
Pydraul F-9 is the **first** and only hydraulic fluid listed by Underwriters' Lab. From the Lab's service card: "The fire hazard of Pydraul is rated 2 to 3 in accordance with Underwriters Laboratories' Inc.'s, Standard of Classification in which Ether rates 100, Gasoline rates 90-100, Alcohol (ethyl) rates 60-70, Kerosene (100° F. flash) rates 30-40 and Paraffin Oil rates 10-20."

WRITE FOR FREE PYDRAUL F-9 BOOKLET!
Organic Chemicals Division, MONSANTO CHEMICAL COMPANY, Dept. OEM-1, St. Louis 1, Missouri

MONSANTO

WHERE CREATIVE CHEMISTRY WORKS WONDERS FOR YOU

1200 SHELL CORES AN HOUR... and AIR DOES THE WORK



AUTOMATION COMES TO FOUNDRIES with Beardsley & Piper's new "Cormatic". Its intricate *all-air* control circuit features 33 MAC valves . . . provides the split-second operation needed to produce up to 1200 close-tolerance shell cores an hour using multiple core boxes.

MAC valves are showing up everywhere . . . and showing up well.

A glance at the "Cormatic" above illustrates the point. Here, on the latest in foundry equipment, 33 MAC air valves are used. You may be sure they'll endure the test of dust, dirt and moisture . . . perform with precision and reliability for millions of cycles.

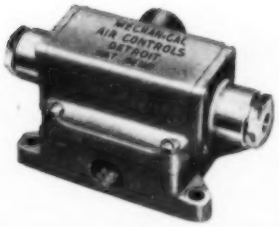
Why not check MAC for all *your* original equipment and replacement needs? You'll find MAC valves light and compact . . . and with fewer parts to wear or cause trouble. It's one of the most complete lines in the industry, too—a wide range of sizes in pilot, pilot-operated and solenoid models.

Contact a MAC field representative, listed at the right, for an assist on any air control application. Or, for free literature, write to:

MECHANICAL AIR CONTROLS, INC.

Office and Factory—10030 Capital, Oak Park, Detroit 37, Michigan

MAC



PHONE YOUR NEARBY "MAC" REPRESENTATIVE FOR DATA AND DELIVERY

CALIFORNIA
OAKLAND 8—The Rucker Co., 4700 San Pablo Ave., OLympic 3-5221
SOUTH GATE—The Rucker Co., 4956 Firestone Blvd., KImball 8271

COLORADO (and NEW MEXICO, UTAH, WYOMING)
DENVER 16—Blair Engineering Co., 4100 Grape St., FLorida 5-7142

ILLINOIS
CHICAGO 43—Mike C. Modrich Co., 10918 South Western Ave., HIlltop 5-3640

INDIANA
FORT WAYNE 3—Neff Engineering Co., P.O. Box 2001, Station A, 2339 Crescent Ave., EAstbrook 7391
INDIANAPOLIS 20—Neff Engineering Co., P.O. Box 7361, 42nd St. Station, BRoadway 2330
SOUTH BEND—Dick Futter, 103 South Varsity Dr., CEntral 2-3800

MASSACHUSETTS (and New England)
BOSTON 34—Electrical Apparatus Co., Inc., 1200 Soldiers Field Rd., STadium 2-7440

MICHIGAN
BAY CITY—Fred Kober, 506 Chilson St., 2-2629
FLINT—Kober Sales Engineering Co., 514 Beach St., CEdar 8-5123
Western Michigan—Everett Adams, 17212 Sharon Road, Chesaning, Michigan; Chesaning 383-J-1

MINNESOTA
MINNEAPOLIS 4—Air Engineering & Supply Co., 2445 Nicollet Ave., FEderal 9-5579
ST. PAUL 14—W. H. Schultz Co., 2438 Franklin Ave., Midway 4-2791

MISSOURI
ST. LOUIS COUNTY—Oscar E. Jost Co., P. O. Box 6, St. Ann, HArrison 8-4488

NEW JERSEY (Northern)
CRANFORD—The Roden Company, P. O. Box 305. CRanford 6-7330

NEW YORK
BUFFALO 21—C. H. Tepas Co., 200 Washington Hwy., CIrcle 3210

OHIO
CINCINNATI—The R. W. Nichols Co., Fidelity Federal Savings Bldg., 2087-9 Sherman Ave., Norwood, ELmhurst 1-2440
DAYTON—The R. W. Nichols Co., 407 Realty Bldg., MIchigan 4724
OLMSTED FALLS—The R. W. Nichols Co., P. O. Box 6, BErea 4-1379
TOLEDO—R. W. Nichols Co., 510 Manhattan Building, Toledo 4, CHerry 1-1447

OREGON
PORTLAND—The Rucker Co., 911 N. W. Hoyt St., BEacon 0205

PENNSYLVANIA
PHILADELPHIA—Grand Air-Hydro Co., P.O. Box 141, Glenside, TUrner 7-4296
PITTSBURGH 22—The R. W. Nichols Co., 101 Investment Bldg., ATlantic 1-6050

TEXAS
DALLAS 19—Womack Machine Supply Co., Shea Rd. at 7150 Harry Hines, FLeetwood 7-3871

WASHINGTON
SEATTLE—The Rucker Co., 1000 4th Ave., South, MAin 2783

WISCONSIN
MILWAUKEE 17—Neff Engineering Co., 5856 N. Pt. Washington Rd., EDgewood 2-1579

CANADA
ONTARIO, HAMILTON—Higginson Engineering Sales. P.O. Box 23 (275 James, North), JAckson 9-2262

MECHANICAL AIR CONTROLS, INC.
DETROIT 37, MICHIGAN

MAC

New Products continued

ELECTRONIC TIMER . . . repeat cycle

Designation: Model 1

Operation: Timer has one vacuum tube, and timing interval depends on charging of two resistance-capacitance networks. One cycle initiates the next without any moving parts or external operation. "On" interval is adjustable from .2 to 200 seconds; "off" interval is adjustable from .1 to 60 seconds. Relay is double-pole, double-throw with contacts rated at 10 amperes on 115 volts. Improvements in this model include isolation from power source, totally enclosed housing and heavy duty terminal strip.

G. C. Wilson & Co.
Huntinton, W. Va.

Circle 163 on Reader Service Card

VARIABLE SPEED DRIVE . . . for limited space

Designation: Types VEV-1-GD, VEV-1-GM

Features: Variable speed, internally geared drive with take-off shaft and motor on the same side is especially adapted to low-speed applications requiring variable speed, and where weight distribution and limited space are factors. Type VEC-1-GD is double reduction and Type VEV-1-GM is triple reduction. Both upright and horizontal assemblies are available for output to 5 hp. Units have either dripproof, totally enclosed or explosion proof motors.

Construction: Castings are heat-treated to remove internal stresses and prevent distortion. Lubrication system provides the largest volume of grease surrounding the bearings, and re-lubrication without disassembling the unit. Windings are asbestos protected to resist burnout.

U. S. Electrical Motors, Inc.
Los Angeles, California

Circle 164 on Reader Service Card

2-WAY AIRCRAFT VALVES . . . with low leakage

Designation: Series 6100, 6200

Design: Valves employ a fully balanced, inverse poppet which allows for a wide range of flows and pressures in either direction without affecting the operating characteristics of the valve. The internal flow configuration minimizes dynamic effect of the flow. Inverse poppet also guarantees perfect alignment with the seat axis assuring low leakage and bind-free performance.

Specifications: Port sizes are designed to meet AND-10050-4, -6, -8 specs. Ambient temperature rating is —65 to 160 degrees F with wider ranges on special order. Solenoids are continuous duty, single coil for 18 to 30 volts dc. Series 6100 is ⅜ inch available with ¼-inch ports. Series 6200 is ½ inch available with ⅜-inch ports.

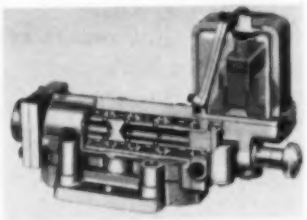
Aircraft Products Co.
Bridgeport, Pa.

Circle 165 on Reader Service Card

Continued on next page

New Products / continued

SOLENOID PILOT VALVES
. . . for simplified maintenance



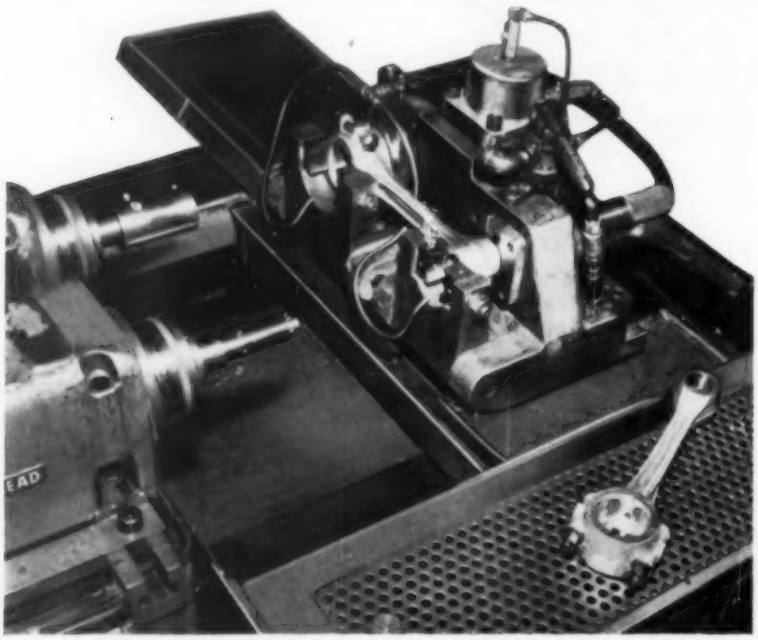
Designation: B-Type

Construction: Valve chambers are formed by aluminum spacers held in accurate metal-to-metal end abutment. This permits O-rings or U-packers to be supported on both inside and outside diameters without placing any mechanical pressure on the packers. Quick field servicing is possible. Packing life is increased, because there is no direct impingement of flow across it. Valve has no lapped joints and no metal-to-metal seating. All parts are in pressure balance, eliminating any tendency to creep.

Design: Sub-base mounted valve has dual exhaust in 4-way types to permit speed control of the operated cylinder by adjustable exhaust plugs. Rated at 600 cycles per minute for continuous operation on 40 to 150 psi air, the valve can be operated at higher speeds with air at 80 to 100 psi. Exterior feed type valves can be used with oil at 250 psi with an air pilot. Valves are available with single and double solenoid, lever, and single and double piloted designs.

C. B. Hunt & Son, Inc.
Salem, Ohio

Circle 166 on Reader Service Card



To cut machine time, consider the

FIXTURE FACTOR

For example — rough and finish boring of forged aluminum alloy connecting rods. This manufacturer designed a *fixture* that saves time. It works by Quincy compressed air. The operator flips a valve handle . . . the fixture snaps open or closed. Fixtures are changed easily for different size rods.

Often speeding up the fixture is the main way you *can* save time, when you're burdened with older equipment. You can also use Quincy compressed air to operate clutches and chucks . . . remove metal cuttings . . . operate hand tools, hoists and precision gages.

But be sure your compressor is a Quincy. Features like loadless starting and Safe-Q-Lube give you a steady supply of air years longer. 21 models from 1 to 90 c.f.m. Ask for Folder 300. Write today to Dept. AH-856.

Quincy COMPRESSORS

QUINCY COMPRESSOR CO. • QUINCY, ILLINOIS

Circle 79 on Reader Service Card

FLEXIBLE COUPLING
. . . for mill motors

Design: Coupling has a sleeve and one hub of standard design. The other hub is taper-bored to specification with a space provided for a nut on the end of the motor shaft.

The overall size of the mill motor type is about 3/5 that of conventional couplings of the same shaft size and about ½ the usual weight. Horsepower capacity is greater than that of conventional flange-and-bolt types. Coupling is available in capacities from 4 to 600 hp per 100 rpm.

Sier-Bath Gear & Pump Co.
North Bergen, New Jersey

Circle 167 on Reader Service Card

MOBILE AIR SOURCE
. . . has high pressure accumulators

Designation: ACE-37

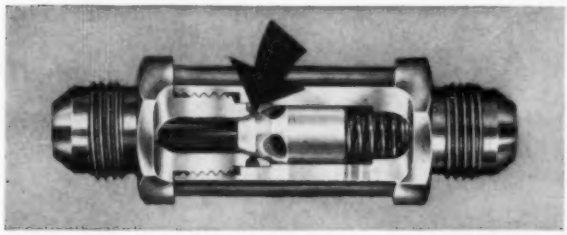
Specifications: Maximum pressure is 3600 psi, and capacity is 18,000 cu in. Accumulator bottles conform to ICC3AA specs. Size of

Continued on page 94

Circle 56 on Reader Service Card

The FLEXIBLE SEAL SEAT*

Simple, Secure, Long-Lasting!



Responsive action of the soft O-ring seal provides absolute leak-tightness. Instantly compresses to seal internal and external pressures. Draws harmlessly around dirt particles. No costly precision parts; no extra end seals. Stocked in 6 standard Dryseal pipe and JIC tube sizes; 12 connection combinations. Write for data sheet.

KEPNER PRODUCTS COMPANY
7321 West 59th Street • Summit, Illinois

Kep-O-seal

HYDRAULIC & PNEUMATIC

CHECK VALVES

* PATENT APPLIED FOR

GET TO WORK 9 TIMES FASTER!

STAR Hi-Lo 2-SPEED PUMP

Ask for Catalog #555.

The STAR Hi-Lo CP14-150 is a 2-speed pump . . . high speed low pressure while bringing the ram into contact with load . . . it actually gets to work 9 times faster than a single speed pump! Then it automatically changes over to high pressure. That saves time, effort, money!

MAXIMUM CAPACITY 10,000 P.S.I.

Safety overload valves—Hard chrome plated pistons—Piston stroke 1½ inch—Oil capacity 150 cu in or larger—5 models: (½"-⅞"), (½"-1¼"), (½"-1½"), (¾"-1½"), (½"-2¼").

Special engineering counsel and proposals cheerfully submitted on request.

Representative areas available

HYDRAULIC AND AIR DRIVEN COMPONENTS — STAR JACK

STAR JACK CO., INC.
420 LEXINGTON AVENUE, N.Y.C. 17
PLANT: RIVER GROVE, ILLINOIS

Circle 95 on Reader Service Card

ARROW

AIR LINE LUBRICATOR

LOOKING INTO THE HEART OF THE PRODUCT

AUTOMATIC OIL MIST LUBRICATION

The Venturi and Porous Bronze Feeder scientifically designed insures complete atomization of lubricant—delivered in correct amount—exactly where required.

"PATENTED"
ARROW LUBRICATOR FEEDER ASSEMBLY

- TAMPER-PROOF ADJUSTMENT
- VISIBLE FEEDER ADJUSTMENT
- AUTOMATIC OIL MIST LUBRICATION ONLY WHEN EQUIPMENT IS IN OPERATION

***ARROW* AUTOPNEUMATIC CONTROLS**

Improve pneumatic machine and tool operation and efficiency. Reduce maintenance and repair costs. Prevent work stoppages.

ALL THE FACTS ARE YOURS . .

ARROW engineers and field consultants at your service.

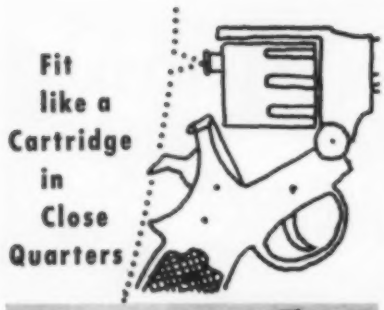
Catalog and engineering data on request.

Your Inquiries Invited.

ARROW TOOLS, INC.
1902 S. KOSTNER AVE. • CHICAGO 23, ILL.

Circle 12 on Reader Service Card

Fit like a Cartridge in Close Quarters



O-M (150 PSI AIR— UP TO 1500 PSI OIL)

TIE-RODLESS CYLINDERS

These compact, streamlined cylinders, that require ⅓ less installation space than the conventional type, slip easily into the hard-to-reach places, because the O-M Special Interlocking Mechanism eliminates both tie-rods and projecting end caps. Besides, the precision honed, seamless steel cylinder body can be turned down to fit in unusually tight spots.

Other important features that reduce maintenance costs and step up efficiency include:

- ***Two Point Bearing,*** one on piston and one in rod gland provide better balance and protect against drag on rod—giving O-M the lowest co-efficient of friction at low or high speeds;
- ***End Covers*** (heads) machined steel;
- ***Leather Back-ups*** on Hydraulic cylinders prevent extrusion on end plugs—O-ring seals;
- ***Piston Packings***—Self-adjusting U-cup, Vee, or ring type;
- ***Rod Packings***—self-adjusting U-cups for air, Vee-type for oil;
- ***Rod Scraper***—cleans piston and protects rod, packing and bearing;
- ***Mounts***—interchangeable, ductile iron or steel—easily installed without disassembling cylinder;
- ***Ports*** can be oriented to facilitate piping;
- ***All Cylinders*** tested at operating pressures before shipment;
- ***Cylinder*** easily disassembled, inspected, serviced, and re-assembled.

Available in a full range of sizes (1½" to 8" bores) with standard, 2 to 1, or oversize rods with male or female rod end, and length of stroke to meet your requirements. Completely interchangeable parts.

Write TODAY for FREE catalog showing cylinders and complete line of mounting brackets.

ORTMAN-MILLER MACHINE COMPANY
1 143rd Street, Hammond, Indiana

☐ Have representative call
☐ Send Bulletin 103

Name_____ Position_____
Company_____
Address_____
City_____ Zone___ State_____

New Products continued

unit is 42 x 38 x 60 inches and weight is 2000 lb.

Features: Originally designed as air source for starting jet engines

in remote areas, unit provides mobility in airfield or factory applications. Lower pressure operation is provided by the addition of suitable reducing valves and controls.

Accessory Controls & Equipment Corp.
Newington, Connecticut

Circle 168 on Reader Service Card

FIRE RESISTANT FLUID . . . has "snuffer" action

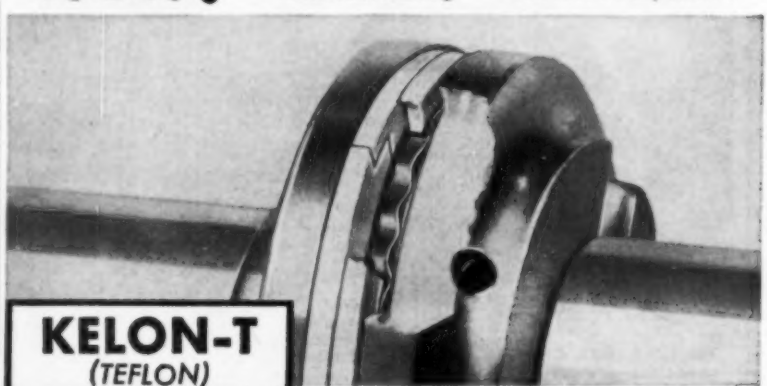
Designation: Irus Fluid 902

Features: Fluid is formulation of water, petroleum oil, and emulsifying agents, and prevents combustion by releasing its water content as a protective steam blanket to quench fires. This "snuffer" action reduces local temperatures and displaces oxygen from the immediate area. In most cases the remainder of the hydraulic fluid will not support its own combustion. The oil will continue hydraulic action should the water be dissipated.

Properties: Fluid is non-corrosive on ferrous and most non-ferrous metals. It is compatible with normal system components, and its film strength provides good anti-wear and anti-scuff protection for closely fitted machine parts. High shear rate viscosities assure maximum hydraulic efficiency over a

Continued on page 96

NOW! For Hydraulic Applications
• Anti-friction • Chemically inert
• Self-lubricating • Pressure responsive



KELON-T (TEFLON)

DUAL PISTON RING SEALS . . .

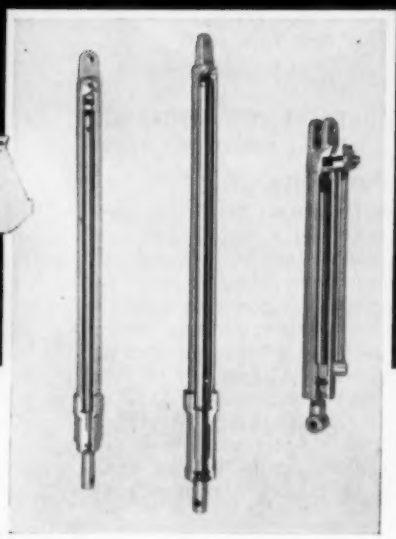
TOUGH, CORROSION-RESISTANT BW Series S-11052 Dual Piston Ring Seals compensate to bore irregularities, and have minimum shift during pressure reversal. Unique joint design and metal expander ring accommodates dimensional changes due to heat and pressure. For piston applications and operating temperatures from —100°F. to +300°F, and pressures up to 3000 psi. Call your nearest Shamban representative or write direct.

KELON

SHAMBAN ENGINEERING CO.
11617 W. Jefferson Blvd., Culver City, Calif.

Circle 74 on Reader Service Card

Circle 85 on Reader Service Card



Powerful Davis Back-Hoe gets its muscles from dependable Republic ELECTRUNITE® Hydraulic Cylinder Tubing

This highly versatile unit, a product of Mid-Western Industries, Wichita, Kansas, thrives on rugged jobs where sheer power and dependable performance are musts.

To get both, a considerable amount of Republic ELECTRUNITE Hydraulic Cylinder Tubing is used in the cylinder assemblies. The Industrial Hydraulics Division of Cessna Aircraft Company, Hutchinson, Kansas, fabricators of these cylinders, has found that this high-quality tubing is ideal to work with for several important reasons.

They like the easy honing characteristics, the ability of the raw tube to clean up and provide a defect-free surface, to the required micro-inch finish. They like the uniform roundness, concentricity and ductility in every inch of tubing. In fact, it's these predictable physical characteristics of Republic ELECTRUNITE Hydraulic Cylinder Tubing that enable manufacturers to establish efficient production procedures.

It will pay you to get all the facts on Republic ELECTRUNITE Hydraulic Cylinder Tubing. You'll discover that a substantial saving is possible on processing costs. Tubing is available in a wide range of sizes and wall thicknesses regularly used in hydraulic cylinder applications. Send coupon for additional information.

REPUBLIC

STEEL

World's Widest Range

of Standard Steels and Steel Products

REPUBLIC STEEL CORPORATION
Steel and Tubes Division
Dept. C-2450
211 East 131st Street,
Cleveland 8, Ohio

I would like additional information on Republic ELECTRUNITE Cylinder Tubing.

Name_____ Title_____

Company_____

Address_____

City_____ Zone____ State_____

New Products continued

wide range of temperatures. Fluid is bright yellow for easy location of leaks. Fluid does not affect packing materials, seals, or hoses, and is suitable for use with most vane and gear pumps.

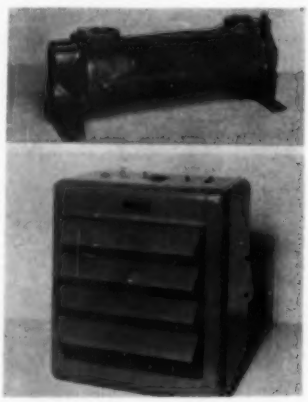
Shell Oil Co.
New York, N. Y.

Circle 169 on Reader Service Card

INDUSTRIAL OIL COOLERS . . . water, air types

Designation: OCW, OCA

Specifications: Water type coolers are available in single-unit sizes for oil flows to 100 gpm and continuous power removals to 37 hp based on 85 degrees F entering water temperatures. Air type coolers are available in single-unit sizes for oil flows to 70 gpm and for continuous power removals to 13.2 hp based on 100 degrees F average ambient temperature. Greater requirements can be met by using units in parallel. Maximum pressure on each side of the water unit is 75 psi, Maximum pressure for the air unit is 150 psi.



Application: Water type has a high rate of heat transfer per unit of space occupied, and quality materials ensure long, maintenance-free life. Air coolers are recommended where cooling water is at a premium or waste heat can be used to warm space. These have a turbulator to break up oil flow for greater heat transfer.

Vickers, Inc.
Detroit, Mich.

Circle 170 on Reader Service Card

AIR VISE . . . 1200 lb capacity

Designation: Power Head

Features: Unit has a guided air-operated movable jaw with 1-inch stroke and spring return. Developed push is 12½ times air line pressure. Device to actuate fixtures on machine tools, welding operations, or assembly lines. Unit comes complete with hand or foot valve and air hose.

Production Devices Inc.
Whitehall, N. Y.

Circle 171 on Reader Service Card

SOLENOID VALVES . . . for 3000 psi

Designation: 9700 Series

Design: Pilot-operated valves have continuous-duty solenoids and subplate mounting. Designed to meet

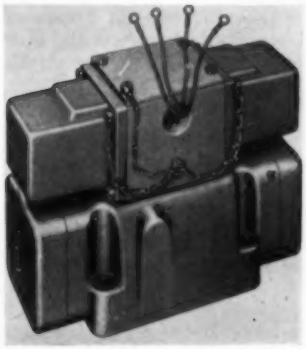
TRU-O-SEAL
TEFLON SEAL
STOPS
PIPE THREAD
LEAKS
instantly!
PAT. PENDING
Prevents future leaks!
TRU-O-SEAL does away with messy pipe "dope" compounds, eliminates damage caused by overtightening of conventional leaky joints, and is immune to ALL known hydraulic fluids and to steam, air, water, solvents, and practically all gases and chemicals. It withstands temperatures from —100° F. to plus 500° F., saves cost and labor of special or welded fittings, and has been fully field tested and proven by leading manufacturers. Comes in ⅛" to 2½" pipe thread sizes.
Write for data and prices
TRU-O-SEAL DIVISION
Flick-Reedy Corporation
2008 N. Hawthorne Melrose Park, Ill.
"Miller Fluid Power" is also a Div. of Flick-Reedy Corp.
1 Thread TRU-O-SEAL on pipe or fitting (no messy pipe "dope" needed). SEAL SIDE
2 Thread pipe or fitting 4 threads into port. Point in desired direction.
3 Tighten TRU-O-SEAL to complete leakproof assembly (only light torque required).

Modernair
ECONOMAIR CYLINDERS
Tops in Quality, Economy, Compactness!
For Air or Hydraulic Service to 200 psi
★ Compact — feed ring head design eliminates bulky end castings!
★ Interchangeable mountings — flange, clevis, L-type
★ "O" ring seals throughout
★ Available in 1⅛", 2" and 3" bore sizes, any practical stroke length, cushion or non cushion types
Economair series cylinders offer today's best buy in quality cylinders at truly competitive prices — why pay more and get less? Write today for complete specifications, prices.
Modernair CORPORATION
Dept. B-8, 400 PREDA ST., SAN LEANDRO, CALIF.
Member National Fluid Power Association
23

Circle 101 on Reader Service Card

Circle 68 on Reader Service Card

JIC specifications, valves have intermediate choke block, spring return, and open and closed-center spools.



Sizes range from 1/8 to 1¼ inches, and valves have low power consumption and full capacity flow through ports and main spool. Bodies are high tensile alloy iron. Valves have long sealing surfaces. Internal or external pilot pressure and drain is available.

Logansport Machine Co., Inc.
Logansport, Indiana

Circle 172 on Reader Service Card

CIRCUIT TESTER
. . . checks flow, temperature, pressure

Designation: Model PT-50-B

Features: Tester is connected by hose to the component port to be tested and to a low pressure return

line. Load is applied manually by the load valve with the result showing on the flow and pressure gages. Pressure range is 300 to 2000 psi. Maximum flow rate is 50 gpm, and temperature range is 60 to 220 degrees F. Screens protect circuits sensitive to foreign particles and are easily cleaned. Unit weighs 19 lb and measures 7 x 11 x 8¾ inches.

Schroeder Bros. Corp.
Pittsburgh, Pa.

Circle 173 on Reader Service Card

Continued on next page

It's worth repeating.. ..for the safety of.. .your men, property. ..and machines.. ..change over to.. UCON Brand Hydrolubes.. CARBIDE'S safety hydraulic fluids..

Before you change over, get all the facts. Find out about their fire resistance and all the other properties, advantages, and procedures for installing, filtering, and maintaining.

Write for Booklet 7380 today.

CARBIDE AND CARBON CHEMICALS

CARBIDE AND CARBON CHEMICALS COMPANY
A Division of Union Carbide and Carbon Corporation
30 East 42nd Street UCC New York 17, N. Y.

"Ucon" is a registered trade-mark of Union Carbide.

Circle 22 on Reader Service Card

New Products continued

SWIVEL FITTING
. . . reduces valve panel size

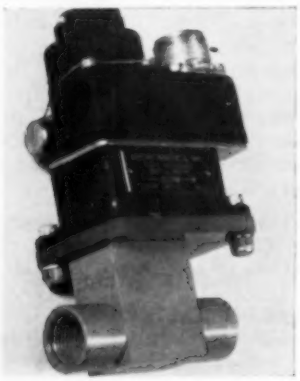
Features: 37-degree swivel nut on one outlet of standard tube fittings such as elbows, side tees, run tees, and crosses permits the installation of panel piping of much less depth. Low pressure-drop direction changes are possible without sweeping tube bends which require more space. Hydraulic panel depth can be reduced ½. Assemblies of run tees also provide a direct means of fabricating a multiple outlet manifold without costly special machining set-ups.

Petch Manufacturing Co.
Detroit, Michigan

Circle 174 on Reader Service Card

2-WAY AIR, OIL VALVE
. . . −320 to + 350 degrees F

Features: Electrically controlled, light weight valve has unobstructed, straight-through flow. Self-cleaning seat arrangement provides a bubble tight seal in the temperature range at pressures to 3000 psi. Valve is actuated by either solenoid or motor that automatically shuts off current when cycle is completed. Available operating time range is from .030 sec to 1.0 sec. Valve is supplied in sizes for ¼ to 1¼-inch.

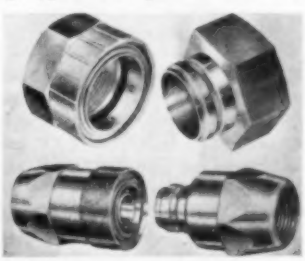


Hydromatics, Inc.
Cedar Grove, N. J.

Circle 175 on Reader Service Card

QUICK COUPLING
. . . greater nipple length

Features: Industrial couplings are supplied in both open and self-sealing types. One-quarter turn locks or unlocks the coupling which has a snap action and will not uncouple with vibration, pressure, or rotation of the hose. Ball-locking groove on nipple is heat treated for longer life



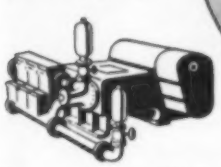
Continued on page 100

Many PROBLEMS

One SOLUTION

Speeds operation, reduces spillage and breakage by absorbing shock.

Stores tremendous power for starting engines.

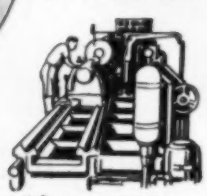


Dampens pump pulsations to prevent failure and damage to system.

U. S. Patents under Olaer Licenses

Lets small motors and pumps operate big presses.

Reduces size, cost, weight, complexity of machine tools.



Furnishes emergency power when pump fails.

Planning a new product? Improving your present equipment? It will pay you to consider using the Greer Accumulator. The application of the most versatile hydraulic component ever devised means improved performance, lower manufacturing and maintenance costs, and greater on-the-job efficiency for your hydraulically operated equipment. Learn how the Greer Accumulator can help you as it has so many others. Write or call Greer engineers for technical assistance with recommendations. No cost or obligation, of course.

Write for Bulletin 301-A for data and diagrams today.

GREER HYDRAULICS INC. • NEW YORK INTERNATIONAL AIRPORT • JAMAICA 30

Circle 13 on Reader Service Card

where tight closing is a "must"

...use

Atkomatic SOLENOID VALVES

guaranteed

LEAK PROOF **BUBBLE-TIGHT**

You're sure of leak proof valve performance with Atkomatic. Atkomatic Solenoid Valves have a specially designed resilient pilot seat and main disc which eliminates metal-to-metal seal when the valve is closed. This pilot seat is available on request at no extra charge. The result is an *absolutely bubble-tight seal* . . . and Atkomatic guarantees it! Atkomatic offers a complete line of solenoid valves for air, gas, liquids and steam. Bronze or stainless steel. Pressures from zero to 5000 psi. Orifice sizes from 1/16" to 3".

send for FREE 20-pg. cat. No. 200.

ATKOMATIC VALVE CO., INC. Dept. 2A, 545 W. Abbott Street, Indianapolis, Indiana

---

TYPE 200

TYPE 201

NEW miniature

QUICK-DISCONNECT COUPLINGS

Eastern's new couplings are the smallest available for high pressure systems. The lightest weight coupling made, Eastern units are used in pneumatic systems, and fluid systems such as hydraulic, and high pressure fuel.

SIZE: 2 3/16" overall length, .95" diameter

WEIGHT: 1.24 oz. (type 200); 1.17 oz. (type 201)

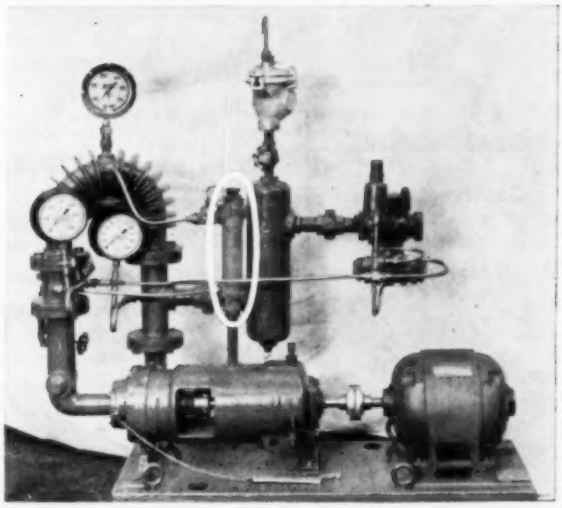
PRESSURE: 1500 p.s.i., maximum operating

FLOW: ½ g.p.m., normal

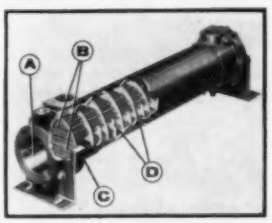
For detailed catalog sheet, write today.

Eastern INDUSTRIES, INC.
100 SKIFF STREET
HAMDEN 14, CONN.

Young Engineering Talent Pays off for Cochrane



Young Coolers cut line losses in condensate return pump system



THE PROBLEM: To eliminate line losses between process equipment and Cochrane Condensate Booster Drainage Control Units.

How Young solved it

Young Type "F" Shell and Tube Heat Exchanger

Young Type "F" Heat Exchangers were specified to reduce water temperature 5 degrees before mixing it with incoming condensate at the mixing tube. Lowering the temperature of the fluid entering the mixing tube offsets line pressure losses . . . boosts pump efficiency.

A. Smooth flow bonnet distributes fluid with minimum turbulence.
B. Tubes are brazed into headers.
C. Gasket eliminates by-passing, fluid leakage.
D. Baffles made to close tolerance.

Write Dept. 446H for FREE Catalog

Put Young Talent to work for you . . .

Solving heat transfer problems is what we do best because it is our very reason for being. You, too, can harness the power of Young engineering talent. Write, wire or call without obligation.

Young RADIATOR COMPANY
RACINE, WISCONSIN
Creative HEAT TRANSFER ENGINEERS FOR INDUSTRY
Heat Transfer Products for Automotive, Aviation and Industrial Applications. Heating, Cooling, Air Conditioning Products for Home and Industry.
Executive Office: Racine, Wisconsin, Plants at Racine, Wisconsin, Mattoon, Illinois

Circle 33 on Reader Service Card

Circle 110 on Reader Service Card

New Products continued

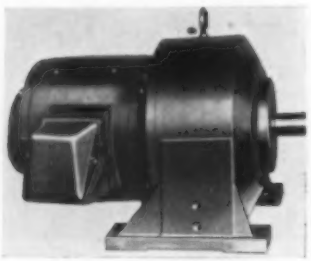
and higher pressures. Nipple length has been increased to withstand greater side loads.

Roylyn, Inc.
Glendale, Calif.

Circle 176 on Reader Service Card

GEAR MOTOR
. . . 1 to 60 hp

Construction: Two-way seals lock oil in and seal dirt out, so that the gear motors may be mounted in



virtually any position without oil leakage. Induction hardening provides extremely hard tooth surfaces on tough alloy steel gears combining strength and wear resistance. Simple gear train is unencumbered by excess mechanisms with fewer parts to wear, less mechanical friction, and better power transmission.

Reliance Electric & Engineering Co.
Cleveland, Ohio

Circle 177 on Reader Service Card

INTERVAL TIMERS
. . . wide timing range

Designation: Type 241

Specifications: Timing ranges are from 15 seconds to 24 hours. New drive and automatic reset mechanism is actuated by synchronous motor which develops minimum torque of 30 inch-ounces at 1 rpm. This exceeds torque developed by hysteresis synchronous motors of comparable size. Repeat accuracy is within ±¼% of full scale. Extra-large, open-blade, silver-cadmium oxide contacts are rated at 15 amps non-inductive load.

Features: Fully enclosed, high-visibility, 300-degree black-on-white dial; black setting pointer; and red progress pointer permit easy reading at a distance and fa-

cilitate rapid setting to precise time intervals. Red start button and extra-large, concentric setting control add to compactness and operating convenience.

Cramer Controls Corp.
Centerbrook, Conn.

Circle 178 on Reader Service Card

SOLENOID AIR VALVES
. . . with full-size passages

Designation; Flo-Line

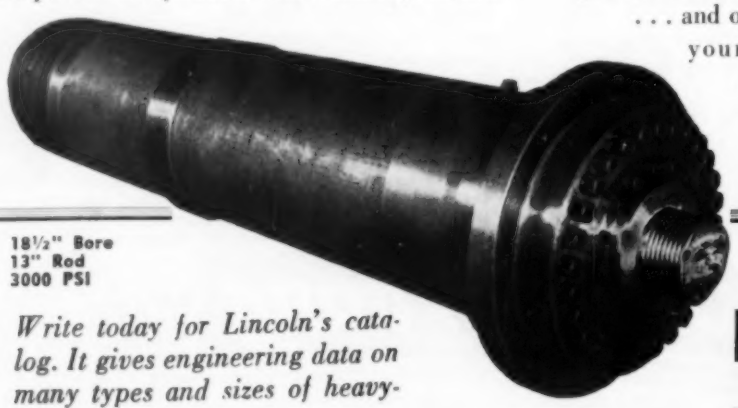
Design: Valves have seals which eliminate damage from external grit

Air and Hydraulic Cylinders

• FOR HEAVY-DUTY APPLICATIONS OF ALL TYPES • TO MEET ALL SIZE AND PRESSURE REQUIREMENTS • BORES TO 32" DIAMETER • STROKES OF 50 FT. AND LONGER

Lincoln Machine Company will design, engineer and build standard or special hydraulic and pneumatic cylinders with trunnion, rod-end flange, blank-end flange, foot, clevis or centerline mountings.

Call on Lincoln when you require large, powerful rotating or non-rotating hydraulic and air cylinders, heavy-duty mill-type cylinders. Our engineering department will give you fast, practical assistance in design problems . . . and our modern plant will build your cylinders quickly and economically.

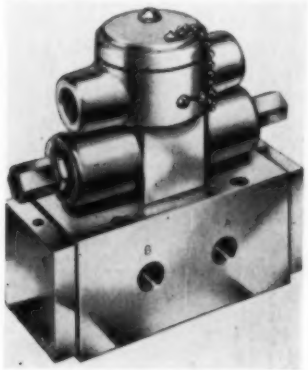


18½" Bore
13" Rod
3000 PSI

Write today for Lincoln's catalog. It gives engineering data on many types and sizes of heavy-duty cylinders.

LINCOLN
MACHINE CO., INC.
326 West 2nd Street—Salem, Ohio

and moisture. Few moving parts are used and parts subject to wear are easily replaceable without possibility of re-assemblying the valve incorrectly. Aluminum, brass, and stainless steel are used for long life. Bubble-tight aluminum spool is sealed by O-rings. Built-in junction box permits convenient piping of conduit, and coils meet Underwrit-

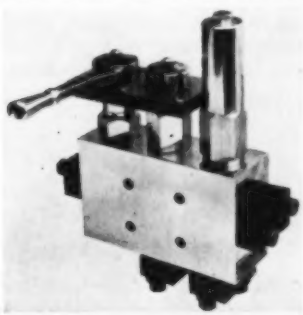


ers Standards. 3 and 4-way valves are available in ¼, ⅜, ½, ¾, and 1-inch sizes. Full size passages prevent restrictions. ½-inch valve passes as much air as a ½-inch line.

Hanna Engineering Works
Chicago, Illinois
Circle 179 on Reader Service Card

DIRECTIONAL HYDRAULIC VALVES
. . . for sensitive control

Features: Valves are produced in a wide range including types for single and multi-pressure systems. Several valves can be combined in



one body to be operated in correct sequence by a single handle. Valves can be operated by air diaphragm or air cylinder. Relief and check valves are also available. Valves have removable tapped steel flanges for pipe connections. Pictured is 3-way valve with high pressure automatically controlled by a change-over unit.

George Ellison Ltd.
Birmingham, England
Circle 180 on Reader Service Card

Continued on next page

Circle 37 on Reader Service Card

New! 3/4" & 1"
Differential Piston Type
Relief Valves

. . . have many applications

- **EFFICIENT — good pressure-flow characteristics**
- **DEPENDABLE—RUGGED — built for rough use on mobile equipment**

- For oil 1500-3000 P.S.I.
- Also available in ¼" & ⅜" pipe sizes

Write for detailed specifications and prices.

Fluid Controls, inc.
Manufacturers of Hydraulic Valves and Devices
Relief Valves • Check Valves • Restrictor Valves
Needle Valves • Pilot Check Valves • Special Valves
Pressure Compensated Flow Regulators
1284 N. CENTER STREET • MENTOR, OHIO

The **NEW AUTO-DIESEL GAPLESS Piston Rings**
1. Reduces air or oil leakage
2. Lower the COST of compressed air
3. You get a more positive stroke
Offers 3 ADVANTAGES

Pat. No. 2,738,243

Here is another Auto-Diesel development that sets a new standard for pneumatic and hydraulic cylinder sealing. It is a complete departure from conventional rings. The Auto-Diesel GAPLESS Piston Ring with the insert reduces oil leakage and assures a more positive stroke. This reduces the cost of compressed air. It can be adapted for high temperatures by changing the insert. It can be made a contracting ring for sealing shafts, bearings or replacing packings, etc., and many other applications.

POSITIVE SEALS *No More Blow Bys*

The main feature is the patented insert that assures a positive seal and prevents blow bys. It can be used as original or replacement in pneumatic operated industrial equipment and for normal pressure hydraulic. Made in sizes from 2" and up. You are assured longer life and greater compression.

Write for Details

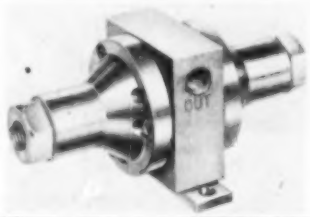
THE AUTO-DIESEL PISTON RING CO.
3137 Superior Avenue • Cleveland 14, Ohio
"RINGS and SHAPES Since 1921"

New Products continued

SAFETY VALVE
. . . ensures 2-hand operation

Designation: N-T-D

Application: To provide 2-hand safety for operators of presses, brakes, etc., No-Tie-Down valve is installed between two parallel palm-button, 3-way valves and the receiver that is to be alternately pressurized and exhausted. If the machine operator engages or disengages only one of the palm button valves, the N-T-D safety valve automatically cuts off any subsequent air flow through itself to the receiver. Re-cocking of the valve for safe 2-hand operation can then be accomplished only by releasing the engaged pilot valve. To permit a reasonable delay between engagement of one palm valve and the other, a tamper-proof, integral adjustment is provided in the valve.



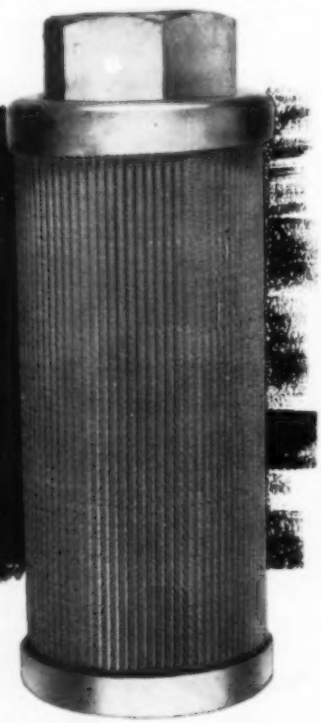
Ross Operating Valve Co.
Detroit, Michigan

Circle 181 on Reader Service Card

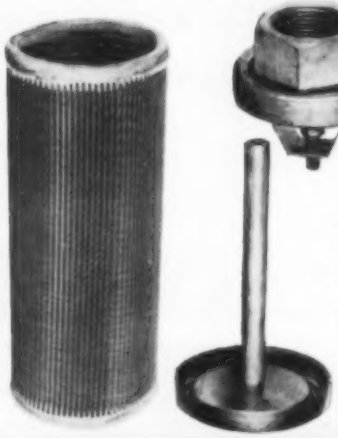
Capital

HYDRAULIC OIL FILTER with Monel Metal Insert

Reservoir Type for Hydraulic and Oil Re-circulating Machinery



EASY TO INSTALL—EASY TO CLEAN
LONG LIFE—LOW COST—SIZES AND SCREENS TO FIT YOUR NEEDS



★ ONLY THREE PARTS
★ MEETS J.I.C. STANDARDS
★ GREATER FILTERING AREA
★ SPECIAL TRAP-WEAVE MESH

Specially woven MONEL wire cloth and a new method of compact corrugation, gives triple protection with less space than other filters of like capacity. Trap-weave mesh stops thin, elongated particles with NO loss of efficiency.

Non-corrosive, non-toxic materials throughout. Easily cleaned with an ordinary brush.

Write for descriptive circular.

CAPITAL ENGINEERING & MFG. CORP.

5836 SOUTH ASHLAND AVENUE, CHICAGO 36, ILLINOIS

AIR HOSE
. . . is lightweight

Designation: Duraprene

Features: Two-braid hose is constructed to meet specifications of oil resistance and is for use at pressures to 200 psi. Hose is available in sizes to ⅜ inch.

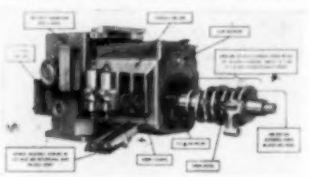
Hamilton Rubber Mfg. Corp.
Trenton, N. J.

Circle 182 on Reader Service Card

HYDRAULIC SEQUENCE CONTROL
. . . is cam actuated

Designation: Hydra-Cam

Design: Device consists of electric motor driven cams which actuate master cylinders. Each cylinder is connected to a slave cylinder



through a closed circuit for feeding, chucking, clamping, loading, gaging, etc. Overload protection is provided for each circuit, and return stroke is actuated by energy stored in an accumulator. Feed rates are unaffected by changes in fluid viscosity. By varying cams any timing and sequence is obtainable as well as any length of stroke within cylinder limitations. Two-speed drive provides for both work and idle cycles.

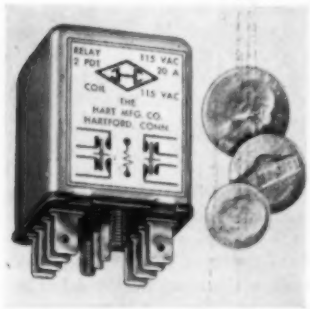
Earl A. Thompson Mfg. Co.
Ferndale, Michigan

Circle 183 on Reader Service Card

RELAYS
. . . heavy duty, small size

Designation: Diamond H Series W

Specifications: Relays can carry resistive loads to 25 amperes at



115-220 volts ac. Vibration resistance ranges from 10 to 55 cps with 1/16-inch total excursion. Relays measure 1½ x 1½ x 1⅞ inches. Coils tested to 1500 volts without breakdown. Spade-type terminals permit fast and easy connecting. Side and panel mounting arrangements are standard, but other mounting arrangements are available.

The Hart Mfg. Co.
Hartford, Conn.

Circle 184 on Reader Service Card

HYDRAULIC PUMP
. . . is self-contained unit

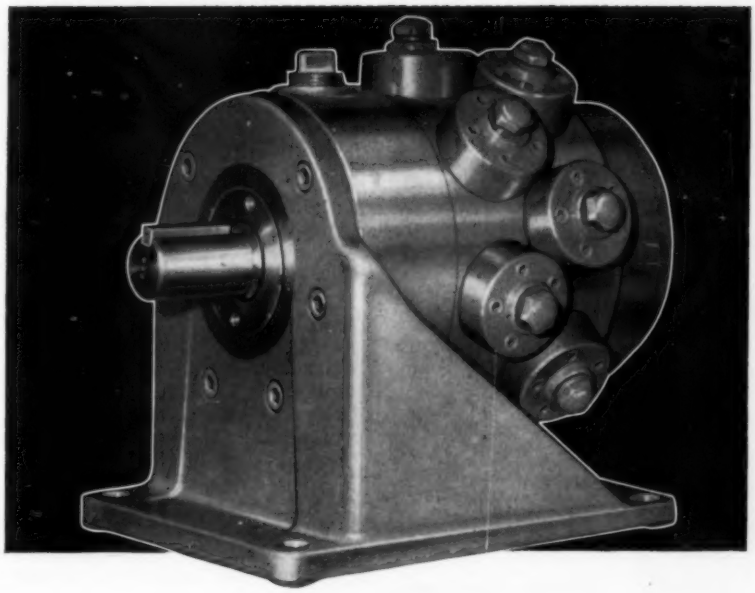
Designation: Model HP-800

Features: Unit requires only one hose line from the pump to cylinder. No power take-off or flexible coupling is needed. The unit has either a 6 or 12-volt electric motor mounted directly on the housing

that contains a control valve, pump, and reservoir. Pump has positive ball-type valves, with all bearing and wearing surfaces bathed in oil. Mounting is with four bolts.

Baughman Mfg. Co.
Jerseyville, Illinois

Circle 185 on Reader Service Card



for HIGH HORSEPOWER—
HIGH PRESSURE service

This Series "C" SECO heavy duty pump is a rugged, revolutionary answer to high pressure, high horsepower requirements. It opens up new horizons in the use of oil hydraulic power.

Pressure is developed *within hollow pistons*—making it possible to generate pressures up to 10,000 PSI without loss of mechanical efficiency. Each piston assembly is completely surrounded by high pressure lubrication and literally *floats* in a hydrostatic film of oil during its pressure stroke. A specially designed oversize Timken bearing assembly insures minimum friction and maximum area of contact at points of piston actuation. *Fluid timed* ball check valves insure quiet and efficient operation at all pressures.

Series "C" SECO pumps are at present made in 2 models, with the following characteristics:

MODEL		C-11	C-5
MAXIMUM PRESSURE, SPOT RATING.....	PSI	5,000	10,000
MAXIMUM PRESSURE, CONTINUOUS RATING	PSI	4,000	6,000
DELIVERY AT MAXIMUM PRESSURE.....	GPM	10	5
SPEED	RPM	1170	1170
POWER INPUT AT MAXIMUM PRESSURE....	H.P.	35	38

If you are interested in high horsepower, high pressure hydraulic power, you should have complete information on these heavy-duty pumps. Use the Reader's Service Card.

SECO

SERIES "C"
"HOLLOW PISTON" PUMPS

SIMPLEX ENGINEERING CO.
ZANESVILLE, OHIO

• Since 1926 • In the application, design and manufacture—pumps separators, hydraulic accessories.

EQUIPMENT FOR FLUID POWER TRANSMISSION

Primary

Oil Pumps

•

Vacuum

Powered

Transmission

and

Low

Pressure

Air Service

•

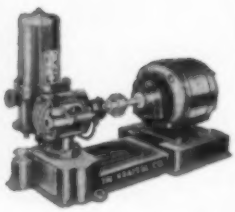
Air

and

Liquid

Filters

•



Rotary Air Pumps for vacuum bottling

Kraissl's patented, automatic, force-feed lubrication and flushing system makes these direct-drive, high-capacity pumps ideal for the special requirements of bottle-filling machinery.

Air-cooled design—or water-cooled models for heavier duty.

Class 21 roller-action pumps are recommended for handling corrosive gases and extraneous matter that might jam with closer clearances. The multi-blade design of the Class 25 pumps gives higher capacity efficiencies and is designed for applications requiring higher degree of vacuum.

Where water-cooling is desired for continuous service, the water-jacketed Class 25-WJ models are recommended.

Our exclusive Class 26 design air filter can be furnished as an integral part of each pump, up to 10 cfm—to produce oil-free discharge air and also conserve the lubricating oil.

Write today for Bulletin A-1289, for air-cooled pumps—and for A-1523 for the water-cooled models.

KRAISSL CO

385 Williams Ave., Hackensack, N.J.

Useful Literature continued

AIR HOSE COUPLINGS . . . hose clamps, hose nipples, valves and manifolds are described and specified in Bulletin 110 prepared by Le-Hi Div. of Hose Accessories Co. The universal type hose couplings all have locking ends identical so that each size and type readily interchanges with another. The safety lock fitting has a positive locking feature which prevents accidental uncoupling. The air hammer hose couplings consist of steel stem with serrated shank, steel spud (male or female), tough malleable iron wing swivel nut and clamp. The standard manifold unit is equipped with one 2-inch female inlet and four ¾-inch female outlets.

Circle 127 on Reader Service Card

TORQUE MANUAL . . . prepared by P. A. Sturtevant Co. gives the general principles of torque wrenches and various methods for their use. The 28-page booklet is a thorough treatment of the design of these tools and suggests many applications. Various types of wrenches are described and illustrated to indicate their features. A section is devoted to attachments such as socket and screwdriver. Information and tables on bolt tension, stud loads, and screw torsional strength are included.

Circle 128 on Reader Service Card

GEAR PUMPS . . . in sizes of 5, 10, and 15 gpm at 2500 rpm and 12, 15, 18, and 23.5 gpm at 1500 rpm are outlined in a brochure presented by George Angus & Co. Ltd., Angus Gear Div. The pumps are rated at 1500 psi, and are available with horizontal foot mounting, vertical foot mounting, flange mounting, and for power take-off. A graph presents information on delivery as a function of speed for seven sizes of pumps, and descriptive material indicates design features of the pumps. The units are provided with special phosphor bronze wear plates. These are easily replaceable for low cost servicing.

Circle 129 on Reader Service Card

SYNTHETIC FLUIDS . . . with high viscosity indexes, low pour points, and excellent lubricity form the subject of 50-page Form 6500D released by Carbide and Carbon Chemicals Co. Div. Carbide and Carbon Corp. The booklet covers properties, applications, and characteristics of these polyalkylene-glycol derivatives. The booklet discusses properties of the fluids, explains the company's product symbols, and indicates applications. Numerous tables are included to indicate properties and test results. Among these are tables indicating effects of different types of fluids on various rubbers, spontaneous ignition temperatures, viscosity-temperature, relationships, and a viscosity conversion table.

Circle 130 on Reader Service Card

PACKINGS . . . for hydraulic and pneumatic applications are included in a booklet prepared by Chicago-Allis Mfg. Co. These leather packings are shown in cup, flange, U, and V styles and sectional drawings indicate power installation in cylinders. The advantages of leather packings are listed and include low coefficient of friction with little heat generation; adaptability to back supports with the resulting elimination of expensive machining and successful operation at subzero temperatures on mobile equipment. The booklet also discusses a one-piece piston with bonded synthetic rubber seal. The efficient lip action of this seal provides a constant seal in either direction with a minimum of wear.

Circle 131 on Reader Service Card

PNEUMATIC TEST EQUIPMENT . . . for supplying moist or dry air for aircraft landing gear, gun firing mechanisms, jet engine starting and jet engine controls is outlined in Catalog KD-101R available from Kahn and Co. Inc. The literature discusses the construction, pressure capabilities, and electrical design of a portable, high-pressure air test stand which can supply air pressures to 3500 psi from a 16-cfm compressor. Also briefly described is special, stationary, high-pressure air and hydraulic test equipment having 5000-psi air and hydraulic systems; dehydration equipment consisting of a moisture separator, two drier towers, dew-point indicator, pressure gage, and necessary valves.

Circle 132 on Reader Service Card

Continued on page 106

SAVE MONEY WHILE SPENDING IT!

Specify

HYDRO-LINE

AIR & HYDRAULIC CYLINDERS

SAVE SPACE...

SPEED PRODUCTION...

SAVE DOWNTIME...

Compact design of HYDRO-LINE Cylinders with *exclusive* quick-change rod cartridge permits immediate replacement of rod seal, double lip rod wiper and rod bushing without removing or dismantling the main cylinder assembly. Other of HYDRO-LINE'S exclusive combination of features includes: all-steel end caps, one-piece piston retained by prevailing torque-type lock-nut, hard chrome plated piston rods, wrench-flats, heavy cushion adjusting needle valve interchangeable with ball check valve. Meet all JIC Standards.

WHEN YOU DESIGN . . . REMEMBER HYDRO-LINE!

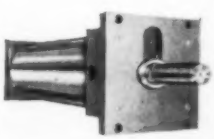
SERIES R—Air or Low Pressure Hydraulic Heavy Duty Cylinder

TYPICAL APPLICATIONS

Clamping Fixtures
Loading & Unloading Devices
Counter Balance
Welding Machines
Air Clutches

•

Bulletin Available at Later Date



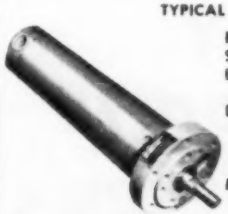
SERIES J—High Pressure Hydraulic Extra Heavy Duty Cylinder

TYPICAL APPLICATIONS

Feed Cylinders
Slide Cylinders
Die Casting Shot Cylinders
Drilling & Tapping Machines

•

Request Bulletin 53



SERIES S—Air or Low Pressure Hydraulic Extra Heavy Duty Automation Cylinder

TYPICAL APPLICATIONS

Clamping Fixtures
Welding Machines
Automation Equipment
Loading & Unloading Devices

Request Bulletin 55

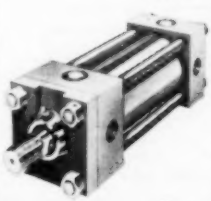
SERIES N—High Pressure Hydraulic Heavy Duty Cylinder

TYPICAL APPLICATIONS

Feed Cylinders
Welding Machines
Die Casting Machines
General Machine Tools

•

Request Bulletin 56



• Hydraulic and Air Cylinders • Dispensing Cylinders • Single Acting Cylinders • Adjustable Stroke Cylinders • Intensifiers

Representatives in all Principal Cities. Write for the name of the Hydro-Line Rep in your locality.

YOUR SAVINGS BEGIN HERE!

Please send bulletin ☐ 53 ☐ 55 ☐ 56

NAME_____

FIRM_____

ADDRESS_____

CITY_____ STATE_____

Hydro-Line CYLINDERS

Remember HYDRO-LINE when you design

HYDRO-LINE MANUFACTURING CO.

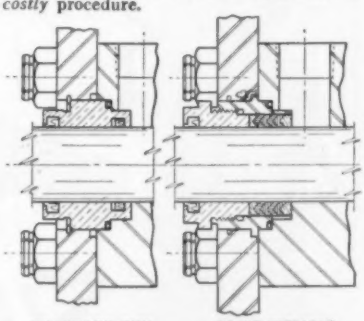
5605 PIKE ROAD • ROCKFORD, ILLINOIS

The ENGINEER'S Corner

As an engineer I am well aware of the importance of flexibility and problems brought about by continuing change which reach my department regularly. Our best answer to change is achieved through interchangeability. We are meeting this challenge by injecting flexibility in our line wherever possible.

Recently we were confronted with this problem of interchangeability on a large scale in a line of transfer machines for processing V-8 engine blocks for a large automotive manufacturer. The machines were designed by several large machine tool manufacturers to conserve all possible production space which meant that the hydraulic cylinders in a majority of the cases would not be mounted in easily accessible locations.

As a result when a severe leak showed up in a cylinder and it failed to maintain pressure the customer knew he would be faced with considerable downtime for cylinder removal and repairs. In some inaccessible locations as much as 8 to 10 hours would be involved. This would mean production stoppage of an entire shift and based on a production rate of 60 blocks per hour a *costly* procedure.



STANDARD "N" CYLINDER | with ADJUSTABLE PACKING

How Hydro-Line provides for interchangeability of Adjustable and Non-adjustable packing in Standard N Cylinders.

The natural solution would be a cylinder on which slow down or repair of a leak could be made until scheduled maintenance could make permanent repairs.

Along with other cylinder manufacturers we were asked to submit our solution. Our proposal was selected because it answered effectively the problem of adjustable packing and equally important because of the interchangeability provided through use of our standard N cylinder.

Our solution was to take our standard N cylinder with non-adjustable packing and equip it with a threaded gland packing retainer. By merely replacing bushings the customer could convert the cylinder from non-adjustable to adjustable packing or vice versa. It enabled the customer to take up the rod packing while the cylinder was still on the machine, stopping small leaks around the piston rod and executing temporary maintenance with complete safety until permanent maintenance could be achieved between shifts. Our standard N cylinder with non-adjustable packing and the converted N with adjustable packing were interchangeable even to end caps and follower. The problem was solved and interchangeability achieved to the complete satisfaction of the customer.

Joseph L. Bosi

Hydro-Line Manufacturing Co.
Chief Engineer

Useful Literature

continued

TIMER . . . of the continuous-cycle, motor-driven type is described in Bulletin C305 from The Bristol Co. The unit is recommended for application to fluid power equipment for operating hydraulic valves, controlling cylinder operations, and controlling time of operation of valves. One to eight cams are available for applications where a number of factors must be accurately controlled according to a time program. Time measurement and pilot valve operation are handled separately eliminating the necessity for the timer to do work. This permits a large timing disc, with 25" scale.

Circle 133 on Reader Service Card

PERMITS THE USE OF MORE ABRASION-RESISTANT, RUBBER-COVERED HOSE

Insure longer wear in your hydraulic hose assemblies—and at the same time, save assembly time by avoiding old-fashioned skiving. Joy Surgepruf re-usable couplings make *both* advantages possible. Their exclusive "double-wedge" grip lets you use tough, abrasion-resistant, rubber-covered hose instead of the braided type—without any need for skiving the hose at the connection.

NO SPECIAL ASSEMBLY TOOLS REQUIRED

You need no mandrels or other special tools to make up Surgepruf assemblies. No extra expense or special technique is involved.

CAN BE RETIGHTENED WHEN LOOSE ON THE HOSE

Machine vibration or hose flexing can loosen any hydraulic coupling on the hose in time, but Surgepruf Couplings can be easily, quickly retightened on the job to stop a leak—*another* exclusive feature.

Surgepruf Hose Couplings are made to JIC Standards. Assemblies are available in many sizes and lengths, and in both single and double-wire reinforced types for medium-high and high pressure service respectively. *Joy Manufacturing Company, Oliver Building, Pittsburgh 22, Pa.*

Get complete data on Surgepruf:
Write for FREE Bulletin 75-19
Consult a Joy Engineer

JOY
HYDRAULIC ASSEMBLIES THAT GIVE YOU MAXIMUM RELIABILITY

WSW H 5506-75

CAP SCREWS . . . manufactured by Standard Pressed Steel Co. are described and specified in a 30-page catalog from the company. Tables are included to show size ranges and specifications such as number of threads per inch, length, and quantities per package. The various fasteners covered include cap screws, set screws, square head set screws, shoulder screws or stripper bolts, button head and flat head socket screws, and pressure plugs. The plugs form a seal without sealing compound and are made of heat treated alloy steel for strength. Also shown in the catalog are dowel pins and socket screw keys.

Circle 134 on Reader Service Card

V-BELT DRIVES . . . form the subject of 44-page Booklet 20P50 prepared by Allis-Chalmers Mfg. Co. In addition to providing selection tables for A, B, C, and D section, variable speed drives, the booklet includes information on design features, drive principles, and horsepower rating tables, a speed range table showing the variation in rpm when two sheaves are used in combination is included. Other tables are given for recommended belt sections, service factors, belt length correction factor, and belt speeds. Sections are also devoted to non-stock drives and special drives.

Circle 135 on Reader Service Card

"THE CASE OF THE SELF-SEALING COUPLING" . . . is an informative booklet prepared by Aeroquip Corp. to provide an analysis of different designs of self-sealing couplings. Self-sealing couplings are considered as consisting of two valves, a device for opening and closing the valves, and connecting members to hold the valve ends together. The booklet lists characteristics which should be designed into a coupling. These include strength in the valve bodies and connecting members, convenience of coupling, unrestricted flow, absence of leakage, and minimum weight and size. Each of these characteristics is discussed, and couplings of various designs are compared.

Circle 136 on Reader Service Card

LECTROLIFT . . . is the trade name for a complete hydraulic power unit for application on mobile equipment described in a data sheet. The information released by Wisconsin Hydraulics, Inc. outlines the performance characteristics, presents dimensional details, and indicates

specifications. The package unit consists of a 1-gpm pump, 6/12-volt motor, 110-cu in reservoir, and check valve, pressure relief valve and control valve. Controls are all fitted integral with the pump to eliminate separate piping, and all working parts are totally enclosed. The control lever has three positions for raising holding and lowering. Speed control by throttling is obtained on the return. The pump is rated at 1600 psi.

Circle 137 on Reader Service Card

OIL COOLERS . . . of both the water type and air type are discussed in Vickers Bulletin 55-69 now available. The design and construction features of each type of cooler are presented as well as a procedure for determining the size of each type. Cutaway views of each type are included, as well as curves to indicate the continuous horsepower removed by the coolers as a function of the oil flow through the cooler. Several examples are given to illustrate size determination. Complete dimensions are given for each type. Typical circuits are shown using water cooled and oil cooled units on small and large systems. Also included in the Bulletin are accessories used with the coolers including a temperature control valve, bulb well, water strainer, and mercury-switch type remote bulb temperature controller. Recommendations for application of these accessories are given.

Circle 138 on Reader Service Card

MANIFOLD MOUNTED VALVES . . . are the subject of an illustrated catalog and technical data sheets available from Versa Products Co., Inc. The valves are especially designed for installations where space is at a premium and where speed of removal and installation are required. The valves are made in 2, 3, 4, and 5-way types in sizes from ⅛ to 1 inch and are rated at 500 psi. Because the valve is independent of the piping, it can be easily removed for service or replacement without disconnecting piping or disassembling the valve. The units are available with any type of actuating device. Standard manifold plates with threaded porting in either the side or bottom are supplied in rolled aluminum. Brass or steel plates can also be supplied.

Circle 139 on Reader Service Card

Continued on next page

Circle 50 on Reader Service Card

Backed by more than a century's experience

BRITISH

Hydraulic Plant & Equipment LEAD THE WORLD

Particulars of Members and their Products will appear in a future announcement.

The Hydraulic Association of Great Britain

•

94/98 Petty France, London, S.W.1. England
Telephone: Abbey 1845.

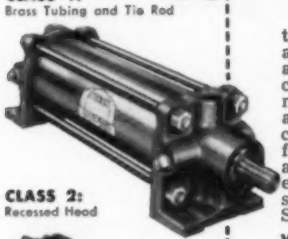
•

Cables: Crusade, Sowest, London

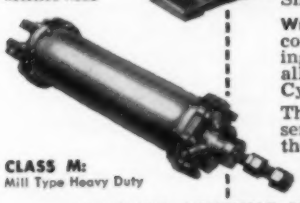
Do it with *AIR POWER*

Apply it with NOPAK Air Cylinders

CLASS 1: Brass Tubing and Tie Rod



CLASS 2: Recessed Head



CLASS M: Mill Type Heavy Duty

There's a size and type of NOPAK Air Cylinder to meet practically every application need. They are available in 3 classes of construction, 6 standard mountings. Class 1 (standard brass tubing and tie-rod construction) is available from Shelf-Stock in standard sizes up to 8" in diameter with 15" maximum stroke. Write for latest Shelf-Stock Listings.

Write for Bulletin 101 which contains complete engineering data and dimensions on all 3 classes of NOPAK Air Cylinders.

There's a NOPAK representative near you. Look in the yellow pages of your Telephone Directory or write —

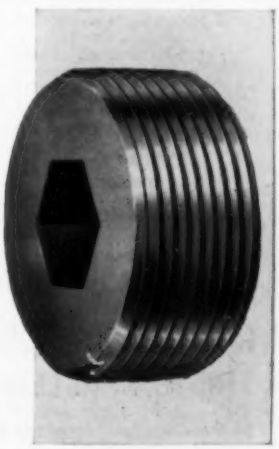
GALLAND-HENNING NOPAK DIVISION
2743 SOUTH 31st STREET • MILWAUKEE 46, WISCONSIN
Representatives in Principal Cities

NOPAK
VALVES and CYLINDERS
for AIR and HYDRAULIC SERVICE

A 8809-1/9

specify standard UNBRAKO

Dryseal-thread Pressure Plugs for hydraulic or fuel systems



Use them wherever liquids or gases must be contained under pressure—or in place of ordinary pipe plugs. UNBRAKOs seal without compound. They are made of the same high-strength alloy steel, have the same internal wrenching feature as UNBRAKO socket screws. Fully formed threads exceed NPTF specifications. Standard sizes—1/16 to 1¼ in.—are stocked by your authorized industrial distributor. See him for details. Or write Unbrako Socket Screw Division, STANDARD PRESSED STEEL CO., Jenkintown 2, Pa.

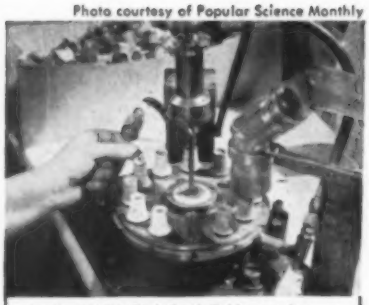
UNBRAKO SOCKET SCREW DIVISION

STANDARD PRESSED STEEL CO.
SPS
JENKINTOWN PENNSYLVANIA

Circle 40 on Reader Service Card

Circle 94 on Reader Service Card

Photo courtesy of Popular Science Monthly



A. K. ALLEN Dial Feed Table revolves as steel discs are hand fed into plastic, noise-maker mouthpieces. Mouthpieces are air-blown to a collection box.

Dial feed table increases output rate 105%!

Installing this A. K. ALLEN Dial Feed Table has upped the production rate of noisemaker mouthpieces 105%! That report comes from the American Merri-Lei Corp., leading producers of party favors.

What is more, says American, "Though we bought our A. K. ALLEN Table 8 years ago, it has worked without a breakdown for every minute it has been in use!"

Victor T. Hoeffich, American Merri-Lei's president, prefers A. K. ALLEN Dial Feed Tables because they are:

1. **Efficient** (Rack and gear drive transmits motion; power is retained through each cycle.)
2. **Indexing is positive, accurate.** (Can be set to index 4, 6, 8, 12 or 24 stations; changes can be made in 15 minutes; *special baffle insures against loss of index!*)
3. **Adaptable to many uses.** (Team it with punch presses, drill presses, spot welders, etc. Load automatically or by hand.)
4. **Easy to install.** (Comes all hooked up and set to operate automatically; just attach one airline to one connection.)
5. **Trouble-free.** (The entire working mechanism is completely enclosed, protecting the precision parts from dust, chips, moisture.)

Find out how A. K. ALLEN Dial Feed Tables can help *your* production.

THE A. K. ALLEN CO.

Agents in Principal Cities

57 Meserole Ave., Brooklyn 22, N.Y.

FREE! For complete information, write for illustrated folder today.

THE A. K. ALLEN CO.
57 Meserole Ave., Brooklyn 22, N. Y AH-86

Please send me your free, illustrated catalog containing data on your Dial Feed Tables

My name_____ Title_____

Company_____

Address_____

City_____ Zone____ State_____

Useful Literature continued

ROTARY JOINTS . . . having a balanced-piston design are presented in Bulletin 14 issued by Sealol Corp. The bulletin shows sectional views and dimensions of three types, and outlines features of the units. The joints are for maximum fluid pressure of 350 psi and speeds to 1750 rpm. The balanced piston design controls the effect of line pressure on the sealing surfaces reducing face-contact pressures to a minimum. The joint is designed for easy maintenance and may be repaired at the machine. The units are self-aligning and self-supporting. They provide automatic take-up for normal wear. Also shown in the bulletin is flexible metal hose assemblies in sizes from ¼ to 1½ inches and lengths from 10 to 18 inches.

Circle 140 on Reader Service Card

THIN WALL TUBING . . . for applications including heat exchanger and cooling system tubing, bellows, flexible metal hose, and solenoid cylinder cores is described in literature released by Superior Tube Co. and designated as Data Memorandum No. 4. The tubing ranges in OD from ⅝ to 2½ inches with wall thicknesses of .035 inch and less. The tubing is produced in both seamless and welded types. The literature gives information on fabrication including bending, beading, flaring, and welding the tubing. A table on standard production limits lists sizes and wall thickness for more than 20 analyses in which the tubing is produced including stainless, nickel, nickel alloy, carbon and alloy steels, beryllium copper, and titanium. Other tables give the standard tolerances for size, ovality, straightness, and length.

Circle 141 on Reader Service Card

BRONZE BEARINGS . . . which are porous and self-lubricating are specified in Stock List S-56 issued by Amplex Div. Chrysler Corp. The booklet covers sleeve bearings, flange bearings, thrust bearings, and cored bar and plate stock. The literature explains that the bearings are oil-cushion units of high oil content fabricated from metal powders. They contain approximately 20% oil by volume. This oil is metered to all portions of the bearing surface by capillary action when heat or pressure is applied. Information for installing and sizing the bearings is given and includes a load-speed chart and dimensions for sleeve bearings. Information for machining the material is also given.

Circle 142 on Reader Service Card

AUTOMATIC TRANSFER SWITCHES . . . Factors to Consider in the Selection of Automatic Transfer Switches is the title of an educational publication by Automatic Switch Co. The 16-page booklet defines an automatic transfer switch as a control device which automatically transfers a load from a normal source to an emergency source upon failure of the normal source. The ten factors of an adequate transfer switch design are listed and include capacity to withstand inrush currents 20 times normal full load rating, built-in time delay, and quiet operation. Each of the ten points is then amplified and explained with engineering data, charts, and circuits. One page of the booklet is devoted to factors that enter into the specification and selection of automatic transfer switches.

Circle 143 on Reader Service Card

HOSE FITTING . . . for industrial and construction hose applications are described and specified in Catalog 18 published by Le-Hi Div., Hose Accessories Co. The catalog covers the company's line of hose couplings, clamps, nipples, hydraulic hose assemblies, valves, and manifolds. The hose couplings are shown in universal type, air hammer service, and heavy duty service. The manifolds are shown for compressed air service and permit use of four hose lines from one supply pipe. The two types of valves shown are pressure seated air valves and throttle valves for use on air compressors, manifolds, etc.

Circle 144 on Reader Service Card

GEAR MOTORS . . . rated from ⅓ to 30 hp with gear ratios as high as 10:1 are detailed in Bulletin 1880 distributed by U. S. Electrical Motors Inc. The publication features cross-sectional details of the motors

Continued on page 110

Circle 38 on Reader Service Card

Just off the Press!

Your FREE Copy Is Ready!

SEND for your *free* copy of the new Foster Quick Detachable Coupler Catalog—#110. Contains diagrammatic layout for applications. Simplified cataloging of coupler types and sizes in all price ranges. Fittings data, etc.

Send today for your free copy—no obligation, of course!

WE HAVE GOOD CONNECTIONS

FOSTER MANUFACTURING COMPANY, INC.

2350 GRAVOIS • DEPT. 13-C • ST. LOUIS 18, MO.

"Wipe out" PACKING FAILURES WITH Seal-Guard METALLIC ROD WIPERS

Self-adjusting, easy to install, Seal-Guard's knife-like bronze rings "wipe off" all dirt and grime, will not mar the rod, are oil and heat resistant and friction-free.

HOW SEAL-GUARD WORKS

1. **Twin wiper rings are mounted on rod with notches staggered.**
2. **Cushion ring is compressed on assembly exerting constant inward pressure keeping ring in constant contact with rod.**
3. **Harmful substances are completely cleared by scraper action.**

Seal-Guards are available to fit rod diameters from ¼ to 24 inches. Other sizes by special order.

WRITE FOR DESCRIPTIVE LITERATURE.

HYDRAULIC ACCESSORIES CO.
24301 Hoover Rd. Van Dyke, Mich.

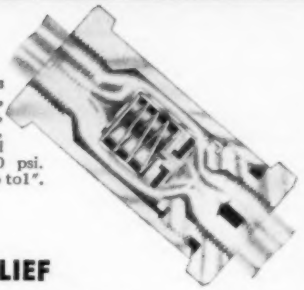
Circle 49 on Reader Service Card

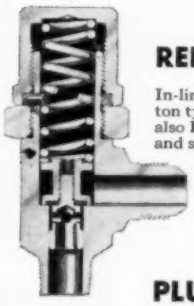
REPUBLIC VALVES

INDUSTRIAL • CHEMICAL • AIRCRAFT

CHECK

Quality Check Valves of several types—ball, poppet, Hy-pressure, Free-flow—all metals, various portings, and pressures up to 3000 psi. Pipe and tube sizes up to 1".



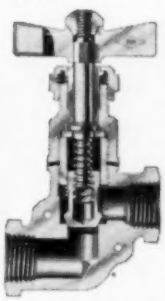


RELIEF

In-line and guided piston type Relief Valves, also Pilot Operated, with quick unloading and silent operation. Metal or rubber seal. ⅛" to ¾" pipe or tube port connections. Various metals.

PLUG

Precision-made Plug Valves for wide general use in brass, aluminum alloy, or stainless steel, ⅛" to 1", +32° to 160°F. With Teflon plug, −65° to 250°F, without lubrication. Aluminum alloy or stainless steel.



GLOBE AND NEEDLE

Super duty shut-off valves, angle and offset, for up to 3000 service, ¼" to 1". Also high pressure Needle Valves for 10,000 psi. working pressure—proofed at 25,000 psi. One piece, stainless steel, ⅛" to ½", Teflon packing.

LO-TORQ SELECTOR

Directional flow control for service up to 6000 psi. Balancing principle uses line pressure to make turning easy with short handle. 2, 3, 4-way, with various drillings. Side, bottom, and sub-plate porting. Panel mounting.

Ask for new catalog, No. 654, showing entire line.

Distributors in principal cities coast to coast.

RM REPUBLIC MANUFACTURING CO.
15655 BROOKPARK ROAD • CLEVELAND 11, OHIO

Circle 80 on Reader Service Card

Useful Literature continued

and enlargements of outstanding details with particular emphasis on the principle of solid shank pinions, integral oil seals, and methods of cutting gears specifically for the motors. A discussion of the application of elliptoidal-helical gears and a chart graphing degrees of tempering and hardening of gear teeth is of special interest. Single, double, and triple reduction motors are shown, the latter employing duplex pinions which permit a division of load on each pinion. A right-angle worm gear motor with ⅓ to ½ hp and cantilever design is also shown.

Circle 145 on Reader Service Card

VALVE STEM PACKINGS . . . manufactured by Raybestos-Manhattan, Inc. Packing Div. are specified in a new brochure. The two general types—asbestos yarns and plastic—are discussed as well as the manner in which they are made, and the shapes most commonly used are given. A table lists size limitations, and a recommendation chart indicates standard items for use against various fluids and gases. All packinges can be supplied with a variety of binders and lubricants to meet individual requirements. In addition, valve stem packing rings, either die-cut or lathe-cut can be supplied from many types of rubber or synthetic rubber with or without fabric reinforcement.

Circle 146 on Reader Service Card

HYDRAULIC CYLINDERS . . . for 2000-psi service are completely described in a new catalog released by the Galland-Henning NOPAK Div. Catalog 104 contains detailed engineering and dimensional data in an easy-to-use form. Feature and parts cross-section drawings, are included. Mounting brackets, rod clevises, and special cylinders are also described.

Circle 147 on Reader Service Card

PRESSURE REGULATOR . . . which has high accuracy using air pressure as the controlling medium is described in Bulletin 544 from Industrial Engineering Corp. The unit which is called Micro Delta p controller is a back-pressure control system complete in one unit. It provides a square-wave pressure response and micro-second control without hunting and with constant pressure through the full flow range. The bulletin shows a sectional drawing of the valve and several variations. Several circuits illustrate applications of the valve.

Circle 148 on Reader Service Card

ROTATING HYDRAULIC DRIVES . . . is the subject of a paper by M. G. Malmquist delivered at the 1955 meeting of the NCIH and reprinted by The Oilgear Co. as Bulletin 15011. The paper discusses problems of web control and presents numerous circuits for speed control. These include series and parallel tachometer synchronized drives, torque controlled drives, and pneumatic-hydraulic drives. In addition to the paper, the bulletin contains a diagram of a recently developed synchronized train drive which can be applied to as many as thir-

Wringing Hose to Death?

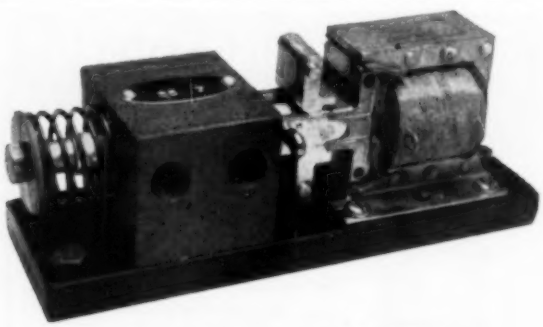
That is one way to kill a chicken. But twisting hose is for the birds!

Mayson Hose Swivels are putting life into hose installations everywhere.

Why not inquire about our nationwide service?

MAYSON MFG. CO.

4332 HORATIO STREET • DETROIT 10, MICH.

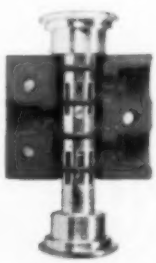


Bachman 4-way Air Valve

¼" pipe ports with orifice equal to .312" diameter.

Stock models include 2-way, 3-way and 4-way action with 110 or 220 volt single or double solenoids.

Cutaway hand valve at right illustrates simplicity of two piece construction.



JOHN D. BACHMAN & CO.

1713 Sparger Lane Bristol, Tennessee

Circle 63 on Reader Service Card

Circle 16 on Reader Service Card

teen machines operating in tandem. The system incorporates a parallel-connected hydraulic tachometer system equipped with a closed-loop, pilot speed control for accurately adjusting and maintaining the speed of the master tachometers.

Circle 149 on Reader Service Card

"METAL FINISHING STANDARDS" . . . is the title of a reference booklet available from The Allen Mfg. Co. The literature is a thorough treatment of plating and surface treatment as applied to the company's products. The first section of the booklet is devoted to general facts on metal finishing and includes a discussion of purposes for various types of finish, thread fits, formulas for calculating thread sizes before plating, quality requirements, hydrogen embrittlement, and protective handling and packaging methods. The second section, tabulates various types of plating giving advantages and limitations, applications, specifications, and appearance of each type. The third section is a similar table for various types of surface treatment. Also included are a corrosion resistance table ,outline of test methods, and a section on stainless steel.

Circle 150 on Reader Service Card

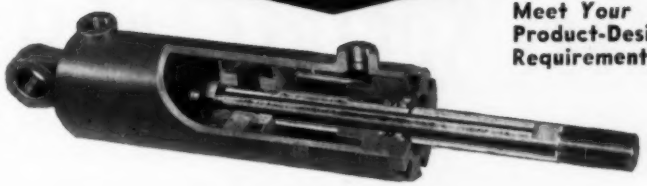
Circle 19 on Reader Service Card

HYDRAULIC CYLINDERS

CUSTOM-DESIGNED

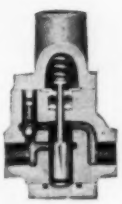
by B.H.E.W.

Meet Your Product-Design Requirements.



Dependable performance in minimum mounting space is characteristic of B H E W hydraulic cylinders. Standard and special O.E.M. designs of all types, sizes and any mounting style are available on order . . . delivered on schedule.

Send specifications of your requirements for ANY kind of hydraulic, pneumatic and water cylinder.



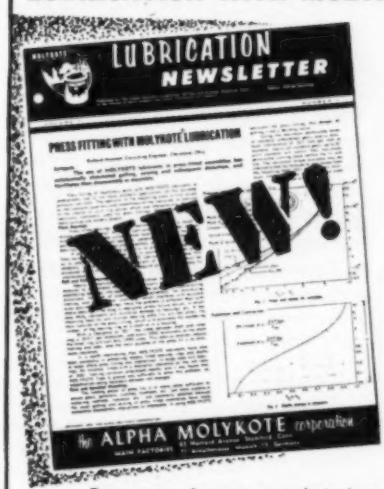
BHEW

Lift trucks need the B H E W Pressure-Operated Hydraulic Flow Control Valve. It eliminates surge as load starts down. Load-weight controls rate of descent.

Benton Harbor Engineering Works, Inc.

St. Joseph, Michigan

A TECHNICAL NEWSLETTER ON LUBRICATION WITH MOLYKOTE . . .



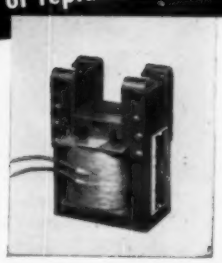
IF YOU HAVEN'T RECEIVED YOUR COPY SEND FOR IT RIGHT AWAY!

Every issue features a technical article on the use of MOLYKOTE Lubricants in industry ● "How-to" stories on tough lubrication applications ● Filled with engineering data which applies to all industries ● Being published regularly.

THE ALPHA MOLYKOTE CORP.

Main Factories: 65 Harvard Avenue, Stamford, Conn. 71 Arnulfstrasse, Munich 19, Germany

NEW! Non sticking, greaseless, long life SHORT STROKE SOLENOIDS for original Equipment or replacement use



PULL CAPACITY
1 to 300 lb at 85% voltage; 1.4 to 420 lb at 100% voltage. Strokes ½ to 1½ inch

INTERCHANGEABILITY
Complete interchangeability with National Acme solenoids.

Only Trombetta Solenoids Offer All These Features: **Heavy non-magnetic** metal guides for plunger head eliminate sticking and dragging; permit mounting solenoid in any position; make it unnecessary for precise plunger alignment; eliminate need for heavy grease lubrication; increase solenoid life and reliability. **Three contact surfaces** which are pole shaded result in quiet solenoid operation. **Three impact surfaces** triple the life of this solenoid as compared with a solenoid having only one impact surface even if that surface has a spot of hard metal. **Impregnating coil** with best waterproof, oil-proof and acid-proof varnishes and baking carefully eliminates troubles.

Solenoids can be furnished for short or long strokes with duty cycles up to 600 per minute. Write for Bulletin EE 178-A

TROMBETTA SOLENOID CORP.

328-A N. MILWAUKEE ST. MILWAUKEE, WISCONSIN U.S.A

Circle 8 on Reader Service Card

Circle 100 on Reader Service Card

Post Scripts of Industry

News about people, manufacturers and sales organizations

Karl W. Galliger
The N. Y. Air Brake Co.

Arthur J. Williamson
Tube Reducing Corp.

Jacques H. Mercier
Greer Industries, Inc.

The New York Air Brake Company has appointed **Karl W. Galliger** as director of engineering. Galliger has been engineering manager of the company's Watertown Division since December 1953. He will now be responsible for company research and engineering, and for organization policies, procedures and development programs of the engineering departments of all the company's divisions.

Promotion of **Arthur J. Williamson** to executive vice president of **Tube Reducing Corporation** has been announced. Williamson, who joined Tube Reducing in 1951 as vice president, had previously served as plant manager of Summerill Tubing Company's Carnegie, Pa., plant. Other promotions made were: **Graham B. Brown** to vice president—operations; **Alvin R. Almquist** to secretary-treasurer; **C. L. Megargle** to general sales manager; and **Walter W. Breden** to assistant secretary-treasurer.

Jaques H. Mercier, former assistant to the president of **Greer Hydraulics, Inc.,** has been appointed production manager of the company's recently formed affiliate, **Greer Industries, Incorporated.** In this capacity he will be responsible for design, compounding and manufacture of hydropneumatic accumulator bladders; manufacture and marketing of the new diiscyanate polyester elastomer Disogrin, and the design of parts incorporating the latter material.

Completion of the second addition to the **Fluid Controls, Inc.,** Mentor, Ohio, plant, since its erection in 1952 was announced by Donald A. Stark, president. The additional facilities will be used for testing, warehousing and shipping.

A plant enlargement and modernizing program has been completed by **Goshen Rubber Co., Inc.** Improvements include construction to increase floor space by 24,000 square feet, extensive additions to molding, processing and power plant equipment and doubling of silicone product fabricating capacity.

William H. Heath has been assigned as manager of the new Connecticut office of **Barksdale Valves.** This office also serves western Massachusetts, Vermont and western New Hampshire. The company also named **Jim Doelger** as the new Milwaukee district manager. This office was opened to cover the northeastern, central and southern areas of Wisconsin.

Charles A. Sereno was elected vice president of **Air Associates, Incorporated.** With the organization for the past eight years, Sereno has served as chief engineer and later as vice president of sales and engineering. He also headed operations at the company's research and development plant.

Continued on page 114

Same filter capacity in 1/5th the space!

That's the advantage Cuno's new, 40-micron SUPER Auto-Klean has over a replaceable-cartridge-type filter!

. . . and you can clean this 40-micron filter simply by turning the handle.

Five to six times smaller in volume than comparable cartridge-type filters of equal capacity, Cuno's new SUPER Auto-Klean® is easy to integrate into new or existing engines, machine tools, or industrial machinery.

It provides positive protection against solid particles larger than 40 microns (actually 0.0015 in.) in lubricating oil, hydraulic fluid, coolant, or other industrial fluids. Here are other features it offers the machine designer:

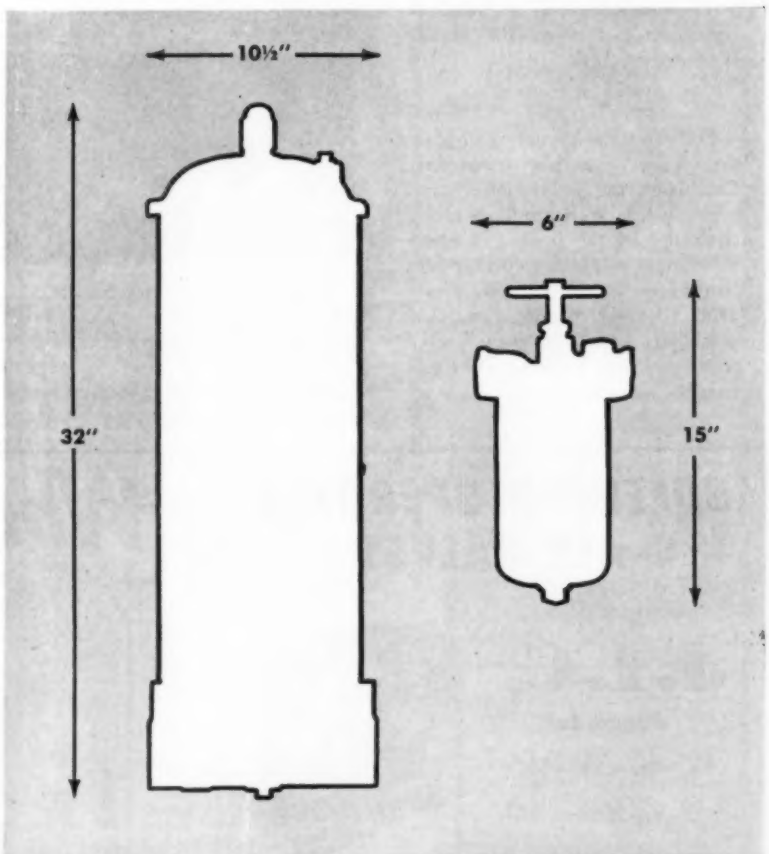
1. Easy cleaning. Just turn the handle—by hand or continuously with motor drive. No interruptions for cleaning.

2. No cartridge changes. Ends operating costs if you've been using cartridge type filters.

3. Low pressure drop, no pressure drop build-up. An 8- by 2¼-in. SUPER Auto-Klean element filters 30 gpm of 200 SSU oil with only 3 psi pressure drop—up to 75% more with slightly higher pressure.

4. Easy to build into new equipment. Standard housings and types available for a variety of mounting designs—in-line housings, flange mounting with external or internal piping. Mounts in any position in sump or reservoir.

5. Easy to install in old equipment. Fits existing Auto-Klean housings. You can easily replace most 2¼-in. diameter elements with SUPER Auto-Klean for finer, more effective filtration.



FIVE TO SIX TIMES SMALLER than equal-capacity cartridge-type filter *(left)*, Cuno's SUPER Auto-Klean *(right)* is ideal for micronic filtration of lube, fuel, hydraulic fluid, coolant in compact engines or machine tools.

Get complete information on this latest and best filter for *your* machine design. We're saving a free copy of SUPER Auto-Klean Catalog No. SAK-057 for you. Write for it today to Cuno Engineering Corporation, 2-8 South Vine Street, Meriden, Connecticut. 5.12

CUNO **ENGINEERED FILTRATION**

REMOVES MORE SIZES OF SOLIDS FROM MORE KINDS OF FLUIDS

AUTO-KLEAN (edge-type) • MICRO-KLEAN (fibre cartridge) • FLO-KLEAN (wire-wound) • PORO-KLEAN (porous stainless steel)

Post Scripts of Industry
continued

Eight top industrial salesmen who sold the greatest volume of filter and filter elements for the **Briggs Filtration Company** were presented with certificates attesting to their efforts in engineering and sales accomplishments. The presentations were recently made at a sales and engineering clinic at the Shoreham Hotel, Washington, D.C.

Following the annual meeting of the **Ajax Flexible Coupling Co., Inc.,** the following officers were elected: **William T. Welch,** chairman of the board; **Wayne Belden,** president; **Harley E. Northrop,** executive vice president; **Charles W. Belden,** vice president; **Robert G. Cady,** treasurer; and **Thomas H. Brumagin,** secretary.

Creole Engineering Company, New Orleans, was appointed as sales representatives for **Valvair Corporation's** products in Louisiana. Creole Engineering's sales are directed by **Ben Louviere,** who has been active for the past ten years in the sale and application of control equipment.

George J. Schwartz was promoted to vice president and general manager of the **Doeclam Division of Minneapolis-Honeywell Regulator Co.** He had been divisional vice president. Schwartz is now responsible for the direction and coordination of operations in all departments of the Boston division.

The New York Air Brake Company has appointed **Nielsen Hydraulic Equipment, Inc.,** Pelham Manor, N. Y., to handle

Continued on page 116

Womack Machine Supply Co., Dallas, Texas, have moved into their new building located at 7150 Hines Blvd. The one story building covers 8700 square feet containing a well equipped machine shop, sales and administration offices. A 2500 square feet warehouse addition is already planned.

SOLENOID OPERATED AIR VALVES

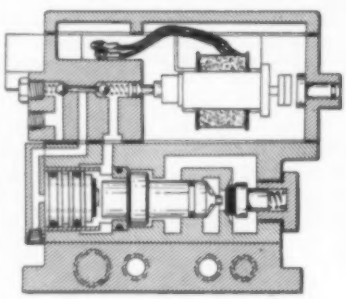
designed to

J.I.C.

standards

¼"-⅜"-½"-¾"

4-Way—Model 441



FEATURES

A—Manual Operating Button

B—Water-tight and Dust-tight Solenoid Enclosure with built-in Electrical Junction Box.

C—Cover chained to Body

Write for Information—Prices

AUTOMATIC VALVE CO.

37419 Grand River Ave. • Farmington, Mich.

What a sight!

CENTURY'S

All-new Oil Level Sight Gage

- No Easier Installation Ever Designed
- Better Visibility at any Height
- Leak-proof—No Dripping
- Streamlined Modern Appearance
- Important Savings in COST
- Available NOW From STOCK

Inquire today . . . make immediate use of the sensational advantages in cost and services offered by this new gage . . .

CENTURY HYDRAULICS, INC.

7701 LYNDON AVE. • DETROIT 38, MICHIGAN

Telephone: DIAMOND 1-3797

Circle 15 on Reader Service Card

Circle 24 on Reader Service Card

WE'RE CROWING ABOUT OUR HYDRAULIC CYLINDERS - CUSTOM BUILT AT MASS PROD. PRICES

SAVE 50%

Our 10 Years of experience filling the needs of Aircraft and Heavy Industry have led to the development of these outstanding Industrial Hydraulic Cylinders. All are Double Action with rugged steel construction throughout. Made to stand pressure up to 1500 PSI and 3000 PSI. Utilizing standard 'O' rings with leather back-up rings on 3000 PSI types. Male clevis mounts on both ends of the Cylinder. Write us Today for further information. We also Custom Manufacture to YOUR SPECIFICATIONS.

PART NO.	BORE	SHAFT	STROKE	LENGTH	Type of CAP	P.S.I.	THRUST	PRICE
P3-4-15E 3	3"	1-1/8"	4	9¼"	External	1500	10,500 LBS.	$34.25
P3-6-15E	3"	1-1/8"	6"	11¾"	"	1500	"	36.75
P3-8-15E	3"	1-1/8"	8"	13½"	"	1500	"	39.50
P3-12-15E	3"	1-1/8"	12"	17½"	"	1500	"	44.75
P4-5-15E	4"	1-1/8"	5"	10⅝"	"	1500	18,750 LBS.	39.50
P4-6-15E	4"	1-1/8"	6"	11⅜"	"	1500	"	41.50
P4-8-15E	4"	1-1/8"	8"	13¾"	"	1500	"	45.75
P4-10-15E	4"	J-1/8"	10"	15⅞"	"	1500	"	50.00
P4-12-15E	4"	1-1/8"	12"	17⅞"	"	1500	"	54.00
P4-5-30E	4"	1-1/2"	5"	10⅝"	"	3000	37,500 LBS.	55.25
P4-6-30E	4"	1-1/2"	6"	11⅜"	"	3000	"	57.25
P4-8-30E	4"	1-1/2"	8"	13⅜"	"	3000	"	61.50
P4-10-30E	4"	1-1/2"	10	15¼	"	3000	"	65.75
P4-12-30E	4"	1-1/2"	12"	17¾"	"	3000	"	69.75
INSERTED CAP TYPE								
P3-4-15-1	3"	1-1/8"	4"	11½"	Inserted	1500	10,500 LBS.	34.25
P3-8-15-1	3"	1-1/8"	8"	17½"	"	1500	"	39.50
P5-12-30-1	5"	2"	12"	21½"	"	3000	59,250 LBS.	85.00
P5-18-30-1	5"	2"	18"	27½"	"	3000	"	97.50
P5-24-30-1	5"	2"	24"	33½"	"	3000	"	115.00
P5-30-30-1	5"	2"	30"	39½"	"	3000	"	135.00

EXTERNAL CAP TYPE

INSERTED CAP TYPE

4-WAY, OPEN CENTER HYDRAULIC CONTROL VALVE

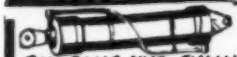
NEW

Has built-in adjustable relief valve, set at 1000 PSI with a spring loaded neutral position. Used for controlling (1) double action cylinder of the types shown in this advertisement. Can also be mounted in series. Has 3/4" standard pipe inlet & outlet ports. 1/2" pipe thread cylinder port. Shipping weight 10-1/2 pounds. . . . . **21.50 NEW**

NEW - HEAVY DUTY HYDRAULIC CYLINDER

A rugged, heavy duty cylinder. All steel construction. Double action. Has 7" bore, 13" stroke, 2½" steel shaft. Ideal for use in hydraulic presses, leveling ramps, hydraulic tail gates, industrial machinery, road machinery, etc. Shipping weight 180 pounds **95.00**

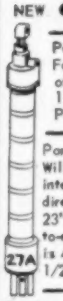
SAVE UP TO 85% ON GOV'T SURPLUS HYDRAULICS



SURPLUS HYD. CYLINDERS

Gov't Surplus Bargain. Produces up to 40,000 lb. thrust with a 3000 PSI line pressure. May also be used as a low pressure air system cylinder. Has a 4" bore, 18" stroke, 30½" length. Part No. 29. New & Used.

NEW **43.95** USED **29.95**



27A

Part No. 27A. Finest Surplus. For use up to 1500 PSI. Has bore of 3½", stroke 21-5/8", shaft 1". Length 29¾". Parts 3/8" AN pipe. **35.77**

Part No. 27B. Similar to above. Will stand up to 2000 PSI. Has internal stroke cushion in both directions. Bore 3-7/8", stroke 23", shaft 1-3/8", eye-to-eye length closed is 40-3/4". Parts are 1/2" AN pipe. **45.00**

27B

Part No. 27C - Similar to 27A above. Take up to 1500 PSI. Has 3-1/2" bore, 23" stroke, 1-1/2" shaft, 34" closed lgth. 1/2" AN pipe ports. **45.00**

180° OFFSET DRIVE

For use where tremendous power at a low take-off RPM is desired. Has 6 gears rotating on self-lubricating, hi-speed roller bearings. 85 to 1 gear ratio. Shafts are 1/4" and 3/8" in diameter. USED . **5.95** NEW - in excellent condition. **8.95**

HYD. HOSE & TUBING

We stock a complete line of Hydraulic Tubing and Hose as well as all types of fittings and hardware. Send us your requirements.

TELESCOPING HYDRAULIC CYLINDER

Thrust shaft is in two stages. First stage extends 39" - the second stage extends 18". Each stage works seperately. The overall length eye-to-eye is 61½". Inner shaft is 2-3/4" dia. outer shaft is 3¼" dia. Bore is 4¼". Ports are 1/2" AN pipe. **165.00**

10,000 PSI HAND PUMP AND RESERVOIR **19.75**

For use with a short stroke press or as a static pressure booster pump. Reservoir mounts vertically with a capacity of 45 cu. inches. Has two position handle. . .

HYDRAULIC HAND PUMP - Has 1500 PSI operating pressure. 1.5 cu. inch capacity per complete cycle. Top condition. **12.75**

4-WAY BANK VALVE

A Bank Valve containing four 4-way poppet type valves. Complete unit has a common inlet and outlet with a built-in relief valve and metering valve. The 4-way valves are independently controlled - pressure balanced with a neutral position. Ports are 3/8" AC tube (9/16"-20 thread **22.50**

SURPLUS VICKERS PISTON TYPE-CONSTANT SPEED-HYD. PUMPS & MOTORS

Made to top Aircraft specifications. RPM shown below is the recommended maximum for constant speed. Quantities limited.

Part No.	Cu. in. per rev.	GPM	PSI	RPM	PRICES NEW	PRICES USED
HYDRAULIC PUMPS						
PF9-713-20BCE	.410	5.3	1000	3000	—	$20.00
PF9-2713-20ZE	.410	5.3	1500	3000	$24.50	—
PF9-2713-10Z	.208	2.7	1500	3000	—	$22.50
PF2-713-25BCE	.507	6.5	1000	3000	$32.50	$22.50
HYDRAULIC MOTORS						
MF9-713-15A	.310	4.46	1000	3750	—	$18.50
MF10-713-30B	.600	9.75	1000	3750	$57.50	—
MF9-713-25BCF	.507	8.25	1000	3750	—	$22.50

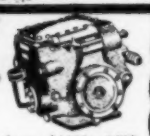
STRATO POWER HYDRAULIC PUMPS

Designed and built to finest aircraft specifications.

PART NO.	GPM	PSI	RPM	PRICE EA.
SP-3	2	1400	3750	NEW $27.50
P3C	20	1500	3750	NEW $125.00

Order from this Ad. Pay by Money Order or Check. P.O.s accepted from well rated D&B firms. 1/2 Dep. with C.O.D.s. Prices F.O.B.

VICKERS AA20328 HIGH PRES. PUMP



Automatic, variable volume of 1850 to 2000 PSI continuous operating pressure. Has a continuous speed of 3750 RPM maximum. Displacement is .600 cu. in per rev. Will deliver up to 9.2 gallons per min. at 3750 RPM. Rotates right hand only. Will operate in any position, but top case drain must be connected to reservoir. Reservoir must be pressurized. Ports are 1" AN inlet and 5/8" AN outlet. . . . . ONLY **129.00**

SURPLUS VICKERS HYDRAULIC TRANSMISSION

Self-contained, constant torque at all speeds with variable volume, reversible piston pump which supplies hydraulic motor. Has 2 H.P. automatic pressure dash pot for smooth control. Power output RPM is 0 to 1/3 input RPM in both directions. Input RPM 1800 continuous, 4000 intermittent. Ideal for Lathes, Duplicator set-ups, Conveyors, Drives, etc. . . . **49.50**

4" SPLINE SHAFTS for input and power take-off on above. $2.50 pair

INPUT & TAKE-OFF PLATE ASSEM. To adapt trans. to pulley drive. Has high speed bearings and 1/2" keyway shaft. Per Set **20.00**

PESCO HYD. PUMP

A gear type pump. Will deliver 2 GPM at 1500 RPM with 1500 PSI - delivers 6 GPM at 4300 RPM with 1500 PSI. Has .375 cu. in. displacement per rev. Ports are 3/4" standard pipe. 5/8" male spline drive shaft. 4" pad mount. In good condition. **14.95**

NEW HYDRAULIC CATALOG

Showing our Complete line of New and Surplus Hydraulic Supplies and Equip. Includes Cylinders in 106 sizes and types. All types Valves, Fittings, Pumps, Hyd. Motors, etc. Write TODAY!

Palley SUPPLY CO.

2263 E. VERNON AVE., DEPT. AH-8 LOS ANGELES 58, CALIFORNIA

Post Scripts of Industry

continued

the Hydreco-Dudco line of hydraulic pumps, fluid motors and valves. The company will handle sales in the New York metropolitan area, Westchester County, northern New Jersey and southern Connecticut.

James W. Rigley
Greer Hydraulics, Inc.

James W. Rigley has joined the **Products Division of Greer Hydraulics, Inc.,** as sales engineer. Rigley will cover the northern New Jersey and New York State territories. He was previously associated with A. Schrader's Son, a division of Scovill Mfg. Co.

An extensive program of reorganization within the **Vickers, Inc.** engineering department has been completed under the direction of **Dr. N. E. Edlefsen,** vice president and director of engineering. Under the new organization, the Engineering Division is comprised of five operating departments in addition to an administrative department under an engineering manager. The research and development department combines, under a director, all groups working on basic research problems in hydraulic and related fields. Design and engineering for each of the company's principal product lines is handled by a separate department, each headed by a chief engineer. There are two aircraft departments. The chief engineers will be responsible for products and complete systems in that field. Each department has separate laboratory facilities for development and testing and are staffed individually.

Dr. N. E. Edlefsen
Vickers Incorporated

Continued on page 118

You get 10 big Integral-Motor-Pump advantages in these two NEW types (three models) of

GAST ROTARY AIR PUMPS

Model 0211
1/6 hp, to 1.3 cfm, 25 psi or 27" vac.

Model 0321
1/4 hp, to 2.2 cfm, 25 psi or 28" vac.

Model 0521
1/3 hp, to 3.8 cfm, 20 psi or 28" vac.

*0321 similar in appearance.

1. Latest type G.E. "Form G" motors.
2. More compact than other pumps.
3. Total weight reduced 1/3—cuts shipping costs.
4. Motor mounting time and labor eliminated.
5. Simple, trouble-free rotary-vane design.
6. Vanes take up their own wear automatically.
7. Positive displacement, pulseless air delivery.
8. Improved appearance—smoother exterior.
9. Dependable for original equipment; plant use.
10. Forced air fan cooling on Models 0321 & 0521.

Write for new Bulletins V-356 and P-356! **Gast Manufacturing Corp.** P. O. Box 117-D, Benton Harbor, Michigan.

Original Equipment Manufacturers for Over 25 Years

GAST • AIR MOTORS TO 4 H.P.
• COMPRESSORS TO 30 P.S.I.
ROTARY • VACUUM PUMPS TO 28 IN.
See Our Catalog in Sweet's Product Design File

Circle 41 on Reader Service Card

3000 psi won't get by the threads of Allen ○ Dryseals!

ALLEN 'TRU-ROUND' Dryseal Pipe Plugs
formed from special analysis ALLENOY steels.

Sold only through leading industrial distributors—specify genuine Allen Dryseal Pipe Plugs.

standard sizes from 1/16" to 1-1/4"

Here's the dependable, metal-to-metal seal you need for hydraulic systems . . . for transmission, control, and automated mechanisms where pressures run high. The N.P.T.F. threads of Allen ○ Dryseal Pipe Plugs are smooth, burnished, and burr-free — do their job without any help from sealing compounds. Allen's unique "pressur-forming" process assures the highest degree of precision threading and dimensional accuracy. What's more, Allen ○ Dryseals are precisely round at root, pitch and crest, with taper held to extremely close tolerances.

Allen engineers will gladly help you to harness your hydraulic pressures. Just write.

ALLEN
MANUFACTURING COMPANY
Hartford 2, Connecticut, U.S.A.

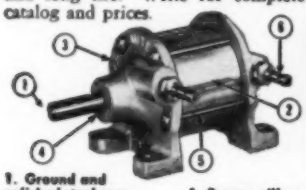
Circle 7 on Reader Service Card

Circle 4 on Reader Service Card

AIR-MITE AIR CYLINDERS

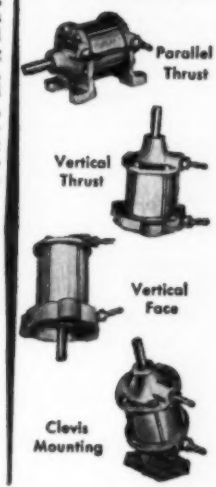
Low Cost . . . Compact . . . Powerful . . . Rugged

AIR-MITE Cylinders—made in single or double acting series—in 4 mounting types, are high quality cylinders at a low price. Simple, rugged design and compact construction give them long life, permit easy mounting on jigs, fixtures, tools, or machines. Used wherever power holding, pushing, pulling or lifting is required, AIR-MITE cylinders will meet your most exacting standards of dependability and long life. Write for complete catalog and prices.



1. Ground and polished steel ram
2. Brass, true-bore cylinders
3. High strength aluminum alloy cylinder heads
4. Bronze oilless ram bushing
5. Five steel tie rods
6. Brass hose stems

4 Mounting Types



AIR-MITE Devices, Inc.

4415 W. CARROLL AVENUE • CHICAGO 24, ILLINOIS

POCKET MANUAL OF ARC WELDING

For Welding Supervisors and Foremen:

Latest welding application data. Revised, pocket-size manual is a concise source of information for those responsible for maintenance and production welding operations.

For Operators and Inspectors:

An easy-to-read reference book that provides practical on-the-spot answers to many arc welding problems—172 pages of necessary working information that can be used in every-day shop work.

The Industrial Publishing Group
812 Huron Rd., Dept. AH
Cleveland 15, Ohio

Please send me —— copies of the POCKET MANUAL OF ARC WELDING at $1.00 each.

Check or money order is attached

NAME .....

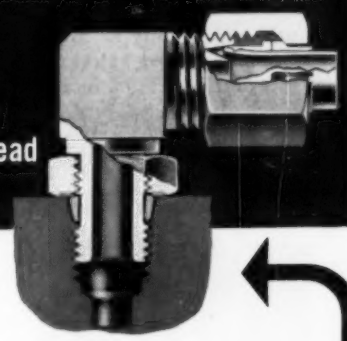
ADDRESS .....

CITY AND STATE .....

HERE'S NEWS!

FLODAR *announces*

ITS NEW
O-RING
LOCKNUT
Straight thread
FITTING



Available in all styles
1/8 to 2 inches

- ★ Positive — Leakproof
- ★ Safer High Pressure Connections
- ★ Meets SAE and JIC Standards
- ★ Easy to Position — Interchangeable

● This new Flodar fitting successfully meets all conditions and problems in the piping field. Now available in Flodar's well-known Self-Flaring, No-Flare and Flare type fittings. They are especially easy to assemble and position . . . are stocked in all different styles and in sizes from 1/8 to 2 inches.

FREE Get the complete FLODAR FITTING STORY *Today!*

WRITE for our two new CATALOGS

FLODAR CORPORATION
16911 St. Clair Avenue Cleveland 10, Ohio

Circle 36 on Reader Service Card

Post Scripts of Industry
continued

Thomas Zurick, who has been associated with the **Marsh Instrument Company** since 1954, has been appointed sales representative in the state of Indiana.

W. L. Komph and **F. J. Theisen** have been elected vice presidents of the Wellman Engineering Company's **Anker-Holth Division.** Komph, who is in charge of sales and engineering, joined the company in 1947 as assistant engineer. In 1951 he was named sales manager. Theisen, vice president, production, has been works manager for several years. He came to Anker-Holth in 1947 as general superintendent.

W. L. Komph
Anker-Holth Division

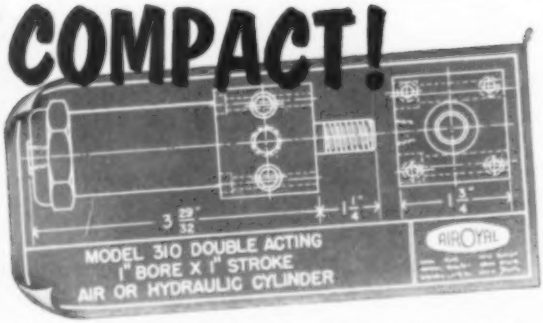
F. J. Theisen
Anker-Holth Division

United States Rubber Co., appointed **Jim J. Orr** as assistant director of engineering. Orr was previously manager of plant engineering in the company's central engineering department.

James-Pond-Clark announced a new company name and a new company division. **Circle Seal Products Company** will handle the industrial sales of the precision valves with **Ed Vernon** as sales manager. **James, Pond and Clark** was organized for the sale of Circle Seal valves to aircraft and other military customers. **Phil Shepherd** is sales manager for this company.

The assets of the **Allen Manufacturing Co.,** Hartford, have been acquired by the **Chicago Pneumatic Tool Co.** Allen will become a wholly owned subsidiary of Chicago Pneumatic Tool. It will retain the same name and present personnel, company and sales policies will not be altered.

COMPACT!



This is an AIROYAL Model 310 — 1" bore X 1" stroke double acting air or hydraulic cylinder. Note its small size. It's been designed into the smallest package possible without sacrificing its strength for severe duty applications. You'll find AIROYAL small bore (⅝", 1", 1½" and 2") cylinders just right for those jobs where space is restricted.

Other features you will appreciate are:

- UNIVERSAL MOUNTING — the cylinder can be mounted from either the two transverse holes or the four longitudinal holes;
- EXTERNALLY HONED STAINLESS STEEL PISTON ROD — resulting in extra long rod packing life;
- LOW PRICE—the cylinder shown above, for either 150 p.s.i. air or 750 p.s.i. oil, is only $27.00 list. $31.00 for pressures to 1500 p.s.i.

MANUFACTURED BY
THE AIROYAL CO
1990 SPRINGFIELD AVENUE
MAPLEWOOD, N. J.
REPRESENTATIVES IN PRINCIPAL CITIES

GRESEN HYDRAULICS

VANE PUMPS
With Dual Vane Feed

For Mobile, Industrial, Agricultural Uses

SPECIFICATIONS
3-6-9-12-16-20-24 G.P.M.
Max. 2000 R.P.M.

ROTATION
Clockwise-Counter Clockwise
Mounting Feet Available

Write for literature

GRESEN MANUFACTURING CO.
628 Colfax Ave. N. Dept. H-16 Minneapolis 11, Minn.

Circle 5 on Reader Service Card

Circle 43 on Reader Service Card

The Briggs Filtration Company has promoted **H. K. Woodward** to general sales manager. A member of the company since 1945, Woodward has served as general industrial sales manager, regional manager, and in various sales, sales development and research capacities.

H. K. Woodward
Briggs Filtration Co.

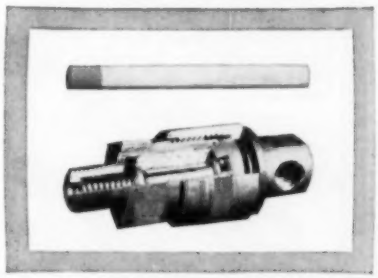
Sparta Manufacturing Company has named these new sales representatives: **Industrial Products Engineering Co.**, Milwaukee, Wis., to cover the entire states of Wisconsin, Minnesota and upper peninsula of Michigan. **Earle P. Keene,** Wynnewood, Pa., for the entire states of Pennsylvania, Massachusetts, Rhode Island, New Hampshire, Maine and a portion of New York and New Jersey. **Meyer Materials, Inc.,** Indianapolis, to serve the state of Indiana. **Nielsen Hydraulic Equipment, Inc.,** Pelham Manor, N. Y., to serve New York City, Connecticut and part of New York.

Ross Operating Valve Co., announced the appointment of **Carl Halpin** as manager of engineering. Halpin has more than 30 years of engineering and manufacturing experience. He formerly was president of the F. L. Jacobs Co.

The newly created corporate position of vice president in charge of engineering for **Minneapolis-Honeywell Regulator Company** has been filled by **Glenn E. Seidel.** He has been a member of the company's engineering organization for nearly 14 years.

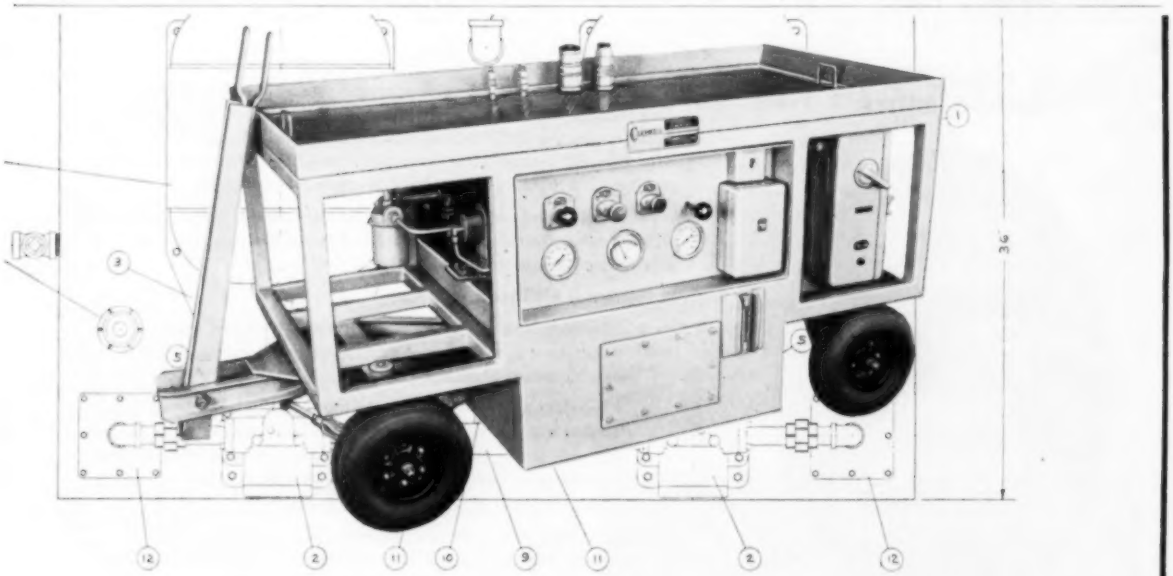
Circle 51 on Reader Service Card

NOW TRY HUSCO
Hydraulic Control-Engineering for Improved Performance, —Space and Cost-Saving



Every Husco Hydraulic Control is custom-engineered for your equipment! We have no "standard" models to push. But our successful experience with hundreds of difficult control problems—confirmed by case histories—promises you the *right* control for your needs... Control Valves, Check Valves, Reciprocating Valves, Hydraulic Cylinders, Pumps, Power Units—they're all engineered to your specific equipment demands for size, capacity, performance.
Check HUSCO *first* for precision engineered Hydraulic Units. You'll save time, money and worry. Write for details.

HUSCO **HYDRAULIC UNIT SPECIALTIES CO.**
Pumps • Valves • Cylinders
Waukesha, Wis.



Produces 1 GPM @ 700 PSI (variable),
50 GPM @ 100 PSI (variable).

APPLICATION:
Testing Airborne Hydraulic Equipment Without Removal From Plane

The **CARDWELL MACHINE COMPANY**
Franklin at 19th St., Richmond 11, Virginia • Phone 7-4593

REVISIONS	THE CARDWELL MACHINE CO. RICHMOND, VA.		
	CARDWELL MOBILE HYDRAULIC TEST UNIT		
	DATE 5-21-56	DWN. BY H.L.W.	8269-1
	CHK. BY C.L.H.	SCALE 3/8" = 1'0"	

Circle 28 on Reader Service Card

RUGGED, HEAVY-DUTY
HYDRAULIC CYLINDERS

Attention: O. E. M.
Prompt delivery on any quantity . . . high quality . . . low cost!

Built-in Mechanical Stroke Control

Free catalog and engineering survey, no obligation.

WRITE...PHONE...WIRE
CROSS MFG. CO.
LEWIS ■ PHONE 81 ■ KANSAS

THE MARKET PLACE

Design Tomorrow's AIRmation Today!

There are men who do not follow the crowd in doing things the same way, day in and day out. The Ross staff of engineers are a hand picked few of these men. Their imaginative solutions to problems in pneumatics have created an ever greater demand for their services; so a few more such engineers must be added to their ranks.

Do you have the experience and resourceful approach to qualify? Then contact us for home office work or your nearest Ross representative for work in the field.

Ross Valve Company
120 East Golden Gate
Detroit 3, Michigan

MECHANICAL ENGINEERS WANTED

Openings for three graduate engineers, familiar with shop procedures, at least 3 to 5 years of design or plant engineering experience involving machinery or materials handling equipment, with some knowledge of hydraulic or electrical control circuits, to design special hydraulically actuated machinery. Permanent position where you will be an individual with responsibility, not a cog in a huge organization. We are constantly expanding in the field of design and fabrication of custom built machinery, power transmissions and control systems for all industry. Located in an area of pleasant, relaxed living. Every kind of outdoor recreation available. Excellent family environment. Outstanding Universities nearby. Send resume and salary range desired to Mr. H. C. Zintz, Chief Engineer, The Rucker Company, 4700 San Pablo Avenue, Oakland 8, California.

ENGINEER-WRITER

Opportunity to join the editorial staff of APPLIED HYDRAULICS Magazine. Man we want must have engineering background and some industrial experience. He will write and edit feature articles. There will be some travel and contact with engineers to gather editorial material. Send your resume to: Editor, APPLIED HYDRAULICS, 812 *Huron Rd., Cleveland* 15, *Ohio.*

ENGINEERS

ELECTRIC BOAT
STEPS-UP
NUCLEAR
SUBMARINE
PROGRAM

offers unusual growth opportunities to engineers

Two years ago, world attention centered on Electric Boat at Groton, Connecticut where scientific boldness harnessed the power of atomic energy to launch the Nautilus, which will soon be followed by its sister ship, Seawolf. Next to glide down the ways will be even more powerful versions . . . a third, fourth and fifth nuclear powered craft.

Now, engineers who are cognizant of the implications of the Atomic Age are concentrating their interest on Electric Boat. The following opportunities exist for:

a) **Naval Architects**

b) **Mechanical and Electrical Engineers** with 3 to 5 years experience in the application of mechanical and electrical marine power plant equipment.

c) **Electrical and/or Mechanical Engineers** for basic design using analog computers, with respect to control systems, motor control circuits, power plant, speed and voltage regulators or fluid flow and thermodynamics. Familiarity with engine room and reactor plant electrical systems and controls desirable.

At Electric Boat your professional success is spurred by company sponsored courses at the plant, advanced study at leading universities, and by attention to broader professional growth by immediate supervision.

Electric Boat's location in Groton on the lovely shore of Long Island Sound makes life as pleasant as your job is stimulating. The surrounding resort area is well known for its year-round sports and recreational activities. And, you have all the advantages of nearby New York and Boston as well.

Interviews can be arranged by sending resumes to Peter Carpenter.

ELECTRIC BOAT
Division of General Dynamics Corporation
GROTON • CONNECTICUT

Advertisers' Index

August 1956

A

Accessory Products Corp. 10
Ace Products Co. 83
Adel Precision Products Div., General Metals Corp. 26
Air-Mite Industrial Air Equipment, Inc. 117
The Airoyal Company 118
A. K. Allen Co. 108
The Allen Mfg. Co. 116
The Alpha Molykote Corp. 111
American Hollow Boring Co. 87
Anchor Coupling Co., Inc. 5
George Angus & Co., Ltd. 40
Arrow Tools, Inc. 93
Atkomatic Valve Co., Inc. 99
Auto Diesel Piston Ring Co. 101
Automatic Valve Co. 114

B

John D. Bachman & Co. 110
Bellows Co. 75
Bendix Skinner Div.
Bendix Aviation Corp. 121
Benton Harbor Engineering Works, Inc. 111
Briggs Filtration Co. 87

C

Capital Engineering & Mfg. Corp. 102
Carbide & Carbon Chemicals Co.,
Division of Union Carbide & Carbon Corp. 97
Cardwell Machine Co. 119
Century Hydraulics, Inc. 114
Chicago Rawhide Mfg. Co. 19
Commercial Shearing & Stamping Co. 61
Crane Packing Co. 38
Cross Manufacturing Co. 120
Cuno Engineering Corp. 29, 113

D

Darling Valve & Mfg. Co. 12
Denison Engineering Co. 79

E

Eastern Industries, Inc. 99
Eastman Mfg. Co. 11
Electric Boat Division, General Dynamics Corp. 120

F

Fawcett-Finney Ltd. 30
Flex-O-Tube Div., Meridan Corp. 86
Flodar Corp. 117
Fluid Controls, Inc. 101
Foster Manufacturing Co., Inc. 109
S. G. Frantz Co., Inc. 84

G

Galland-Henning, Nopak Division 107
Gast Mfg. Corp. 116
Greer Hydraulics, Inc. 98
Gresen Manufacturing Co. 118

H

Hanna Engineering Works 1
Hansen Mfg. Co. ..... Cover 2
E. F. Houghton & Co. 15
Hydraulic Accessories Co. 109
The Hydraulic Association of Great Britain 107
Hydraulic Unit Specialties Co. 119
Hydro-Line Mfg. Co. 105

J

Johns-Manville 22
Joy Manufacturing Co. 106

NOW—AN ENTIRELY NEW
Bendix-Skinner
HYDRAULIC OIL FILTER

Approx. ½ size

OFFERING YOU FINER
FILTRATION AT LOWER COST!

Here's everything you've wanted in a filter, including a built-in bypass—and all at a price equivalent to only six quarts of hydraulic oil! Yes, this newest addition to the Bendix-Skinner* line is truly the last word in efficient, yet economical, filtration. Its sturdy aluminum die cast construction assures long service—trouble-free, because it is available with either cleanable "ribbon" type elements for 40-micron filtration, replaceable "pleated" type for 10-micron filtration, or "disc" type, cleanable in 5 or ½ microns. Two ¼-inch N.P.T. inlets and two ¼-inch N.P.T. outlets make installation quick and easy. Operating pressure—100 p.s.i. Complete flow rate-pressure drop data on request.

*TRADE-MARK

BENDIX-SKINNER DIVISION OF
P.O. BOX 135, ROYAL OAK, MICHIGAN
Bendix AVIATION CORPORATION
Export Sales: Bendix International Division, 205 East 42nd Street, New York 17, N. Y.
ORIGINATOR OF MICRONIC FILTRATION

Do you have the facts on Linear's new, exclusive ROTO-MOLD process? It brings *automation* to the packing industry—makes possible fast delivery of perfectly uniform "O" Rings in any quantity!

★ Linear ROTO-MOLD "O" Rings are made with laboratory precision in single cavity molds under individually controlled pressure. Molding dies are automatically brought into microscopic alignment.

★ Every ROTO-MOLD "O" Ring is perfectly circular in cross section, with no transverse or other seams. You get precise uniformity without trimming or grinding.

Linear ROTO-MOLD "O" Rings are available now, in a variety of sizes and compounds, to meet your exacting requirements. Write, phone or wire for complete details.

"PERFECTLY ENGINEERED PACKINGS"

LINEAR

LINEAR, Inc., STATE ROAD & LEVICK ST., PHILADELPHIA 35, PA.

ADVERTISERS' INDEX

K

Keelavite Rotary Pumps & Motors, Ltd. 67
Kepner Products 93
Koppers Company, Inc., Metal Products Div. 36
Kraissl Co., Inc. 104

L

L & L Manufacturing Co. 78
Lear, Inc. 20, 21
Lincoln Machine Co., Inc. 100
Linear, Inc. 122

M

Marvel Engineering Co. 45
Mayson Manufacturing Co. 110
Mechanical Air Control, Inc. 90, 91
Metal Industries, Ltd. 30
Miller Fluid Power Div., Flick-Reedy Corp. 28
Minnesota Rubber & Gasket Company 2
Modernair Corp. 96
Monsanto Chemical Co. 89

N

New York Air Brake Co. 17
Niagara Blower Co. 8
Wm. W. Nugent & Co., Inc. 24
Numatics, Inc. 4

O

Ortman-Miller Machine Co. 94

P

Palley Supply Co. 115
Pathon Mfg. Co. 73
Pesco Products Div., Borg-Warner Corp. 81
Precision Rubber Products Corp. 7

Q

Quincy Compressor Company 92

R

Republic Manufacturing Co. 109
Republic Steel Corp. 85
Resistoflex Corp. 83
Reuland Electric Co. 13
Rivett Lathe & Grinder, Inc. 85

S

Shamban Engineering Co. 94
Shell Oil Co. 68, 69
Shenango-Penn Mold Co. 32
Simplex Engineering Co. 103
Skinner Electric Valve Div., The Skinner Chuck Co. 37
Snap-Tite, Inc. 43
Socony Mobil Oil Co., Inc. 9
Sprague Engineering Corp. 64
Standard Oil Co. (Indiana) 77
Standard Pressed Steel Co. 107
Star Jack Co., Inc. 93
Sun Oil Co. 33, 34
Superior Tube Co. 16

T

The Texas Co. 46
Tomkins-Johnson Co. 39
Trombetta Solenoid Corp. 111
Tru-Seal Div., Flick-Reedy Corp. 96

U

U. S. Gasket—Belmont Packing 35
U. S. Gauge Div., American Machine & Metals, Inc. 14
U. S. Rubber Co., Naugatuck Chemical Div. 25

V

Vickers, Inc., Division of Sperry-Rand Corp. 31
Victor Equipment 88
Henry Vogt Machine Co. 23

W

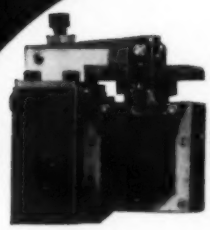
Waterman Engineering Co. ..... Cover 3
Webster Electric Co. 27

Y

Young Radiator Co. 99

CONTROLS YOU CAN depend ON

WATERMAN CONTROLS
for accuracy—dependability
safety—low maintenance cost



SOLENOID VALVES

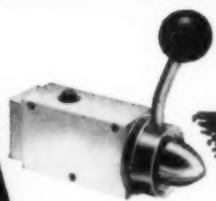
For working pressure to 3000 psi. Remote control of hydraulic systems for handling non-corrosive fluids.

LOOK TO WATERMAN

MICRONIC LINE FILTERS

Operating pressures to 3000 psi. 40 micron filtration. Replaceable elements. Available in ⅜" and ¾" NPT.

FOR THE ANSWER TO



ADJUSTABLE FLOW REGULATORS

Full range from 0.5 GPM to 20 GPM. All Waterman Flow Regulators maintain a constant rate of flow regardless of work resistance or pressure fluctuations.

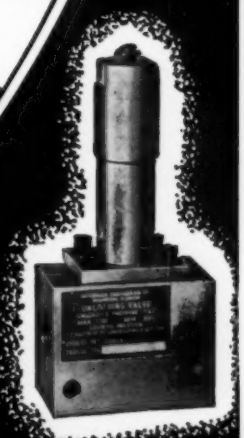
YOUR FLOW CONTROL

CHECK VALVES

One piece. Leak proof. Nylon Poppet. Aluminum body. Low pressure drop.

REQUIREMENTS

Write for bulletin A of any of these products



UNLOADING VALVES

UNLOADING VALVES for system pressures to 3000 psi. Flow rates to 30 G.P.M. Fast acting, easily adjustable, maintain desired pressure settings without continuous readjustment. Hardened poppets eliminate leakage. Large passages assure maximum flow with minimum pressure loss.

WATERMAN
ENGINEERING COMPANY

725 CUSTER AVENUE • EVANSTON, ILLINOIS

Circle 108 on Reader Service Card

The terrible vengeance of Joseph P. Fyffe

ON A WARM August evening in 1870, a footsore stranger in naval officer's uniform walked into East Haddam, Conn.

His name was Joseph P. Fyffe, and he was revenging himself on the Navy for refusing to advance him travel money to proceed to his new station, San Francisco.

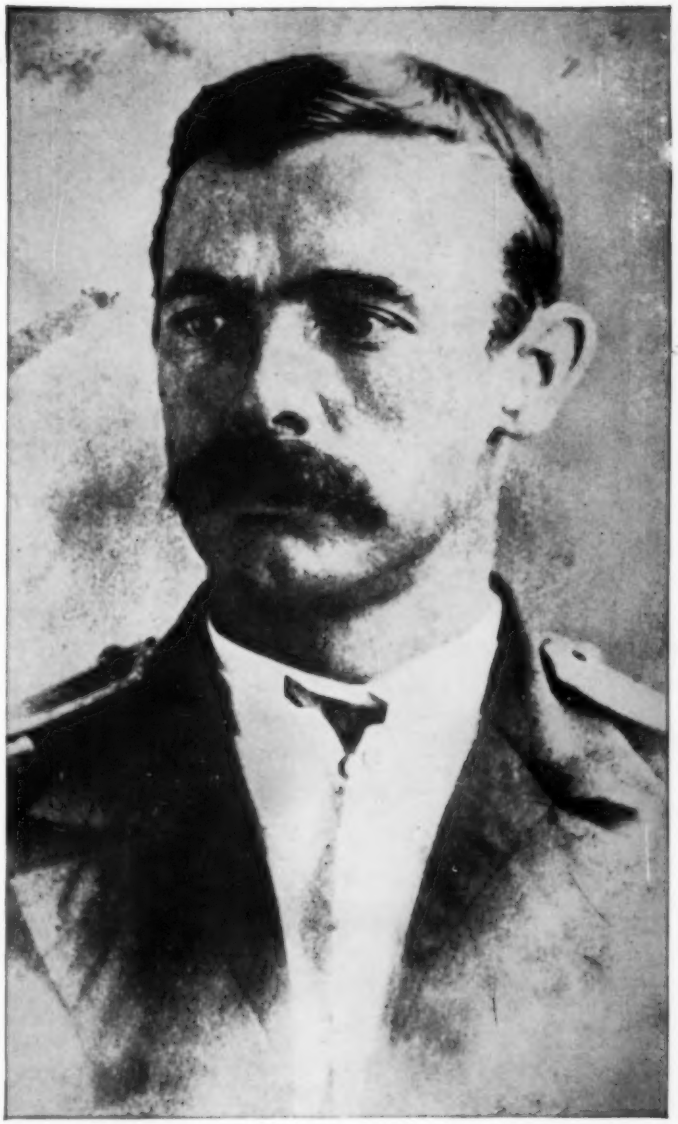
He was trudging cross-country *on foot.* And conscientiously wiring in daily progress reports well-calculated to give his superiors apoplexy. His sixth, from Albany, N.Y., read in part:

> *"Entered Albany barefooted X Comfortable X Earning my keep as bartender X Local rum far superior that served in Navy X Am sending sample"*

At this, the Navy struck its colors, reversed its time-honored tradition, and began prepaying travel allowances.

Strangely enough, Joe Fyffe actually wound up as a rear admiral. That, of course, was years later; and he has long since passed to his reward. But his vigorous and outspoken independence is still alive and kicking in today's Americans. That's why our country is a strong, vital nation and why our country's Savings Bonds are one of the finest investments in the world.

165 million Americans stand behind U.S. Savings Bonds. *There is no better guarantee.* So buy Bonds regularly—and keep the ones you buy.



★ ★ ★

It's actually easy to save—when you buy Series E Savings Bonds through the Payroll Savings Plan. Once you've signed up at your pay office, your saving is done *for you.* The Bonds you receive pay good interest—3% a year, compounded half-yearly when held to maturity. And the longer you hold them, the better your return. Even after maturity, they go on earning 10 years more. So hold on to your Bonds! Join Payroll Savings today—or buy Bonds where you bank.

Safe as America – U.S. Savings Bonds

The U.S. Government does not pay for this advertisement. It is donated by this publication in cooperation with the Advertising Council and the Magazine Publishers of America.